Honeywell Enraf

# Service Manual
# SmartRadar FlexLine

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**CHAPTER 1 General . . . . . 1-1**
**1.1 Target Group for this Service Manual . . . . . 1-1**
**1.2 Structure of this Manual . . . . . 1-1**
**1.3 Trademarks . . . . . 1-1**
**1.4 Contact . . . . . 1-2**
**CHAPTER 2 Safety . . . . . 2-1**
**2.1 General . . . . . 2-1**
**2.2 Safety Conventions . . . . . 2-1**
2.2.1 Warnings . . . . . 2-1
2.2.2 Cautions . . . . . 2-1
**2.3 Safety Instructions . . . . . 2-1**
2.3.1 Safety Instructions . . . . . 2-1
2.3.2 EC Declaration of Conformity (for EU) . . . . . 2-2
2.3.3 Control Drawings for FM & CSA . . . . . 2-2
2.3.4 Users . . . . . 2-2
2.3.5 Additional Information . . . . . 2-2
2.3.6 Environmental Conditions . . . . . 2-2
**2.4 Liability . . . . . 2-2**
**2.5 Labels . . . . . 2-3**
**2.6 Personal Safety . . . . . 2-3**
**2.7 Warnings and Cautions . . . . . 2-4**
2.7.1 General . . . . . 2-4
2.7.1.1 Opening of the Instrument . . . . . 2-4
2.7.1.2 Closing of the Instrument . . . . . 2-4
2.7.1.3 Tools . . . . . 2-4
2.7.1.4 Working Environment . . . . . 2-4
2.7.1.5 Required Skills . . . . . 2-5
**2.8 Commissioning and Maintenance . . . . . 2-5**
**2.9 Accordance to Regulations . . . . . 2-5**
2.9.1 Explosion Safety . . . . . 2-5
2.9.2 Compliance to radio communication equipment approvals . . . . . 2-7
2.9.2.1 R & TTE (Radio & Telecommunication Terminal Equipment) . . . . . 2-7
2.9.2.2 FCC (Federal Communication Commission) . . . . . 2-7
2.9.2.3 IC (Industry Canada) . . . . . 2-8
2.9.3 EN302372-1 ANNEX B . . . . . 2-9
2.9.4 Low-Voltage Directive . . . . . 2-9
**CHAPTER 3 System Architecture . . . . . 3-1**
**3.1 SmartRadar FlexLine Architecture for R120 and R220 . . . . . 3-1**
**3.2 FlexConn Modules . . . . . 3-4**
**3.3 Entities . . . . . 3-8**
3.3.1 Status Entities . . . . . 3-8

3.3.1.1 Health Entity . . . 3-8
3.3.1.2 Commissioned Entity . . . 3-10
3.3.2 Generic Entity . . . 3-10
3.3.3 Function-specific Entities . . . 3-10
**3.4 SmartView Display . . . 3-11**
3.4.1 General . . . 3-11
3.4.2 Status Entities on SmartView . . . 3-12
3.4.3 Generic Entities on SmartView . . . 3-13
3.4.4 Specific Entities on SmartView . . . 3-13
**3.5 Engauge Service Tool . . . 3-14**
3.5.1 Status Entities in Engauge . . . 3-15
3.5.2 Generic Entities in Engauge . . . 3-15
3.5.3 Board-specific Entities in Engauge . . . 3-15
3.5.4 Specific Entities on Engauge . . . 3-15
3.5.5 Function-generic Entities on Engauge . . . 3-15

**CHAPTER 4 Service Tools . . . 4-1**
**4.1 SmartView . . . 4-1**
4.1.1 General . . . 4-1
4.1.2 SmartView Versions . . . 4-1
4.1.3 Connections . . . 4-1
4.1.4 SmartView Controls . . . 4-2
4.1.5 SmartView Menu Structure . . . 4-4
4.1.5.1 SmartView Screens . . . 4-4
**4.2 Engauge . . . 4-17**
4.2.1 Connecting the Engauge Service Tool . . . 4-17
4.2.1.1 Wired Connections Situation (FIGURE 2-17) . . . 4-17
4.2.1.2 OneWireless Situation (FIGURE 2-18) . . . 4-18
4.2.2 Using Engauge . . . 4-18
4.2.3 Some Engauge Screen Examples . . . 4-20
**4.3 Configuring OneWireless infrastructure . . . 4-22**
4.3.1 Configuring WDM using the First Time Configuration Wizard . . . 4-22

**CHAPTER 5 Installation . . . 5-1**

**CHAPTER 6 Configuring the OneWireless Network Components for R220 . . . 6-1**
**6.1 Provisioning the OneWireless Network components . . . 6-1**
6.1.1 Provision the WDM using over-the-air provisioning method . . . 6-1
6.1.2 Provision SmartRadar FlexLine field devices using over-the-air provisioning method . . . 6-3
6.1.3 Provision SmartRadar FlexLine field devices using SD card . . . 6-6
6.1.4 Removing the provisioning key from SmartRadar FlexLine gauge . . . 6-6
6.1.5 Resetting the provisioning key from SmartRadar Flexline gauge using a SD card . . . 6-7

**6.2 Configuring SmartRadar FlexLine field device . . . . . 6-7**
6.2.1 Loading the Device Description file . . . . . 6-7
6.2.2 Configuring routing assignment . . . . . 6-8
6.2.2.1 Considerations . . . . . 6-8
6.2.3 Configure tag name and description . . . . . 6-9
6.2.4 Configure publication rate . . . . . 6-9
**6.3 Configuring SmartRadar FlexLine field device channels . . . . . 6-11**
6.3.1 Configure Mode and Scale . . . . . 6-11
6.3.2 Add channels to publication groups . . . . . 6-11
6.3.3 Remove channels from publication groups . . . . . 6-12
**6.4 Activating SmartRadar FlexLine field device in OneWireless Network 6-12**
6.4.1 Activate ENRAF Ethernet UDP interface on OneWireless user interface . . 6-13
6.4.2 Configure CIU Prime and CIU Plus using the Ensite Pro configuration tool 6-14
6.4.3 Monitor performance of ENRAF interface . . . . . 6-14
6.4.4 Configuring field devices . . . . . 6-15
6.4.4.1 Configure field device properties . . . . . 6-15
6.4.4.2 Configure publication rate . . . . . 6-15
**6.5 Configuring the protocol tunneling . . . . . 6-16**
6.5.1 Configure SmartRadar FlexLine field device interface . . . . . 6-17
6.5.2 Configure ENRAF serial interface . . . . . 6-18
6.5.2.1 Serial interface connection . . . . . 6-19
6.5.3 Configure ENRAF Ethernet/UDP interface . . . . . 6-21
6.5.3.1 Install and configure the Lantronix device . . . . . 6-21
6.5.3.2 Assign IP address to the Lantronix device . . . . . 6-21
6.5.3.3 Configure Standard Serial Tunnel settings on the Lantronix device . . . . . 6-21

**CHAPTER 7 Commissioning . . . . . 7-1**
**7.1 General . . . . . 7-1**
7.1.1 Introduction . . . . . 7-1
7.1.2 Text Conventions . . . . . 7-1
**7.2 Enraf Fieldbus (HCI-BPM) . . . . . 7-2**
7.2.1 Introduction . . . . . 7-2
7.2.2 Commissioning the HCI-BPM . . . . . 7-3
**7.3 Enraf GPU-FlexConn / Modbus Protocol (HCI-GPU) . . . . . 7-5**
7.3.1 Introduction . . . . . 7-5
7.3.2 Specifications . . . . . 7-6
7.3.3 Commissioning the HCI-GPU - Modbus Protocol . . . . . 7-7
7.3.3.1 Introduction . . . . . 7-7
7.3.3.2 Modbus Protocol Description . . . . . 7-7
7.3.3.3 Commisioning Notes . . . . . 7-9
7.3.3.4 Commisioning . . . . . 7-11
7.3.3.5 Modbus Holding Registers . . . . . 7-12
7.3.3.6 Status Information . . . . . 7-23

7.3.3.7 Modbus Coils . . . 7-31
7.3.3.8 Modbus Exception Handling . . . 7-31
7.3.4 Standard ASCII codes . . . 7-34
**7.4 The OneWireless Communication Option (HCI-1WL) - Double slot (for R120) . . . 7-35**
7.4.1 Introduction . . . 7-35
7.4.2 Potential Electrostatic Charging Hazard . . . 7-36
7.4.3 Adding a Radar to the OneWireless Network . . . 7-36
7.4.3.1 Introduction . . . 7-36
7.4.3.2 Preparing the Radar . . . 7-37
7.4.3.3 Authentication . . . 7-37
7.4.4 Removing a Radar From the OneWireless Network . . . 7-38
7.4.5 Commissioning the HCI-1WL in the OneWireless Network for R120 . . . 7-38
7.4.5.1 Introduction . . . 7-38
7.4.5.2 Transducer Blocks for R120 . . . 7-40
7.4.5.3 Commissioning the HCI-1WL Configurable Transducer Blocks . . . 7-55
**7.5 The OneWireless Communication Option (HCI-1WL) - Single Slot (for R220) . . . 7-58**
7.5.1 Introduction . . . 7-58
7.5.2 Potential Electrostatic Charging Hazard . . . 7-59
7.5.3 Adding a Radar to the OneWireless Network . . . 7-59
7.5.3.1 Introduction . . . 7-59
7.5.3.2 Preparing the Radar . . . 7-60
7.5.3.3 Authentication . . . 7-60
7.5.4 Removing a Radar From the OneWireless Network . . . 7-60
7.5.5 Commissioning the HCI-1WL in the OneWireless Network for R220 . . . 7-62
7.5.5.1 Introduction . . . 7-62
7.5.5.2 Transducer Blocks for R220 . . . 7-62
7.5.5.3 Commissioning the HCI-1WL Configurable Transducer Blocks . . . 7-71
7.5.6 Commissioning the HCI-1WL for GPU and FlexConn Communication . . . 7-73
7.5.7 Using the SmartView with the OneWireless Communication Option . . . 7-76
7.5.7.1 Introduction . . . 7-76
7.5.7.2 SmartView OneWireless Status Display . . . 7-76
7.5.8 Radio Board Diagnostic Information and Commands . . . 7-77
7.5.8.1 Introduction . . . 7-77
7.5.8.2 Commands . . . 7-78
7.5.8.3 Diagnostic Information . . . 7-78
7.5.9 Advanced Settings - Transmission Power Level . . . 7-80
7.5.10 Firmware Upgrade for R120 . . . 7-81
7.5.11 Firmware Upgrade for R220 . . . 7-81
7.5.11.1 Upgrading the SmartRadar FlexLine device firmware using Wireless Device Manager . . . 7-81
7.5.11.2 Upgrading the SmartRadar FlexLine firmware using the Engauge service tool... . . . 7-83
**7.6 Product Level Measurement (TII-XR) . . . 7-85**

7.6.1 Introduction . . . 7-85
7.6.2 Basic Commissioning . . . 7-85
7.6.2.1 General . . . 7-85
7.6.2.2 Level Start-Up . . . 7-86
7.6.2.3 Level Check . . . 7-88
7.6.2.4 Alarm Settings . . . 7-90
7.6.2.5 Alarm Loop Checking . . . 7-91
7.6.2.6 Compensations . . . 7-91
7.6.2.7 Errors and Warnings . . . 7-98
7.6.2.8 Additional Information . . . 7-98
7.6.2.9 Overfill Protection Application . . . 7-99
**7.7 Relay Contacts (FII-DO) . . . 7-99**
7.7.1 Introduction . . . 7-99
7.7.2 Operation Mode . . . 7-100
7.7.3 Relay Configuration . . . 7-101
7.7.3.1 Jumper Settings . . . 7-101
7.7.3.2 Relay Mode . . . 7-101
7.7.4 Alarm Mode . . . 7-102
7.7.4.1 PV Monitor . . . 7-102
7.7.4.2 Remote Control . . . 7-104
7.7.4.3 Not in Use . . . 7-104
7.7.5 Commands . . . 7-104
7.7.5.1 Activate . . . 7-105
7.7.5.2 Deactivate . . . 7-105
7.7.5.3 Acknowledge . . . 7-105
7.7.6 LED Association . . . 7-105
7.7.7 Terminal Allocation . . . 7-106
7.7.8 Commissioned Entities . . . 7-107
7.7.9 Board Commissioned Entity . . . 7-108
7.7.10 Fail-safe Level Application . . . 7-108
7.7.11 Overfill Protection Application . . . 7-110
7.7.11.1 Introduction . . . 7-110
7.7.11.2 Essential FlexConn Boards . . . 7-110
7.7.11.3 Application Principle . . . 7-110
7.7.11.4 Overfill Protection Board Actions . . . 7-111
7.7.11.5 Merging the Status to GPU-level status . . . 7-114
7.7.11.6 Overfill Protection Application Wiring . . . 7-115
7.7.11.7 Commissioning the Overfill Protection Application . . . 7-115
7.7.11.8 Proof Testing . . . 7-118
**7.8 SmartView Display Interface (FII-SMV) . . . 7-119**
7.8.1 Introduction . . . 7-119
7.8.2 Commissioning the FII-SMV . . . 7-120
7.8.3 Reading the SmartRadar FlexLine field device information from the SmartView . . . 7-121

**7.9 Pressure & Density Measurement and Other HART Inputs (FCI-HT) . 7-122**
7.9.1 Introduction . . . 7-122
7.9.2 Software Description . . . 7-123
7.9.3 Software Specifications . . . 7-127
7.9.3.1 General . . . 7-127
7.9.3.2 P1 Pressure . . . 7-128
7.9.3.3 P3 Pressure . . . 7-129
7.9.3.4 HIMS Density . . . 7-131
7.9.3.5 Generic HART Devices . . . 7-132
7.9.3.6 Function Identification . . . 7-134
7.9.3.7 SmartView Display . . . 7-136
7.9.4 Board Commissioning . . . 7-137
7.9.4.1 Function 1 Commissioning . . . 7-137
7.9.4.2 Function 2 Commissioning . . . 7-138
7.9.4.3 Function 3 through 7 Commissioning . . . 7-138
7.9.4.4 Function 8 Commissioning . . . 7-139
7.9.5 Hardware Configuration . . . 7-141
7.9.5.1 Terminal Allocation . . . 7-141
7.9.5.2 LED Allocation . . . 7-141
**7.10 HART Analog Outputs (HCI-HAO) . . . 7-142**
7.10.1 Introduction . . . 7-142
7.10.2 Functional Description . . . 7-143
7.10.3 Other HCI-HAO features . . . 7-145
7.10.4 Calibration of the HCI-HAO . . . 7-146
7.10.5 Board Commissioning . . . 7-148
7.10.5.1 Basic Configurable Entities Overview . . . 7-148
7.10.5.2 Commissioning . . . 7-149
7.10.6 Hardware Configuration . . . 7-153
7.10.6.1 Jumper Allocation . . . 7-153
7.10.6.2 Terminal Allocation . . . 7-153
7.10.6.3 LED Allocation . . . 7-153
**7.11 Average Temperature & Water Level Measurement (FII-VT) . . . 7-154**
7.11.1 Introduction . . . 7-154
7.11.2 VITO Interface Types . . . 7-155
7.11.3 Commissioning . . . 7-155
7.11.3.1 Commissioning Parameters for MTT/LT Probes . . . 7-155
7.11.3.2 Commissioning Parameters for MRT or RTD . . . 7-162
7.11.3.3 Commissioning Parameters for the 765 VITO Water Probe . . . 7-168
7.11.4 Commissioning Check . . . 7-170
**7.12 Average Temperature Measurement (FII-RTD) . . . 7-171**
7.12.1 Introduction . . . 7-171
7.12.2 Some Important Settings . . . 7-172
7.12.3 Some Important Features . . . 7-172
7.12.4 Commissioning . . . 7-175

7.12.4.1 Commissioning Parameters for 1 or 2 RTDs (3- and 4-wire) Temperature Calculations . . . . . 7-175
7.12.4.2 Commissioning Parameters for MPT Temperature Calculations . . . . . 7-176
7.12.4.3 Commissioning Parameters for MRT Temperature Calculations . . . . . 7-176
7.12.4.4 Commissioning Parameters for All Types of Probes . . . . . 7-177
7.12.5 Commissioning Check . . . . . 7-181

# CHAPTER 1 GENERAL

## 1.1 Target Group for this Service Manual

The SmartRadar FlexLine Service Manual is intended for service engineers who are assigned to commission the SmartRadar FlexLine.

## 1.2 Structure of this Manual

| Chapter Title | Description |
|---|---|
| 1 - GENERAL | This chapter provides the introductory information for the manual. |
| 2 - SAFETY | This chapter provides all the essential and mandatory safety instructions, precautions, and measures. It also describes the safety conventions used, the labelling information, and the compliance information. |
| 3 - SYSTEM ARCHITECTURE | This chapter provides an introductory impression of the SmartRadar FlexLine's modular-shaped hardware architecture. |
| 4 - SERVICE TOOLS | This chapter provides the description of the SmartView and the Engauge service tool. |
| 5 - INSTALLATION | This chapter provides a reference to the *Installation Guide* for the SmartRadar FlexLine to make sure the relevant module(s) are accurately installed, before starting the commissioning. |
| 6 - CONFIGURATION | This chapter gives all information required to configure the OneWireless infrastructure, SmartRadar FlexLine devices, and protocol tunneling. |
| 7 - COMMISSIONING | This chapter provides the information required for an accurate commissioning of one or more SmartRadar FlexConn modules. |

## 1.3 Trademarks

HART® is a registered trademark of the HART Communication Foundation.

## 1.4 Contact

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# CHAPTER 2 SAFETY

## 2.1 General

The SmartRadar FlexLine is a radar-based level gauge which is used in inventory measurement systems. It can also be used to interface with other systems and sensors such as pressure, density, or temperature sensors.

For the correct and safe servicing of this product, it is essential that all personnel follow the generally accepted safety procedures in addition to the safety precautions specified in this manual.

## 2.2 Safety Conventions

### 2.2.1 Warnings

The following warning symbol is used in this manual to urge attention in order ***to prevent personal injuries*** or dangerous situations, further described in this manual.

| Symbol | Description | Remark |
|---|---|---|
| | General warning | Will always be explained by text. |

### 2.2.2 Cautions

The following caution mark is used in this manual to urge attention in order ***to prevent damages to the equipment*** further described in this manual.

| Symbol | Description |
|---|---|
| | General caution sign |

## 2.3 Safety Instructions

### 2.3.1 Safety Instructions

See the safety instructions shipped with the device for installation, commissioning, operation, and maintenance.

### 2.3.2 EC Declaration of Conformity (for EU)

Refer to the EC declaration of conformity shipped with the device.

### 2.3.3 Control Drawings for FM & CSA

Refer to the control drawings shipped with the device.

### 2.3.4 Users

The mechanical and electrical installation must be carried out only by trained personnel with knowledge of the requirements for installation of explosion-proof equipment in hazardous areas.

The entire installation procedure must be carried out in accordance with national, local, and company regulations.

The entire electrical installation shall be carried out in accordance with the national requirements for electrical equipment to be installed in hazardous areas.

### 2.3.5 Additional Information

If you require additional information, contact Enraf or its representative.

### 2.3.6 Environmental Conditions

Observe the environmental conditions for the temperature and the pressure.

## 2.4 Liability

The information in this installation guide is the copyright property of Enraf B.V., Netherlands. Enraf B.V. disclaims any responsibility for personal injury or damage to equipment caused by:

- Deviation from any of the prescribed procedures,
- Execution of activities that are not prescribed,
- Neglect of the safety regulations for handling tools and use of electricity.

The contents, descriptions and specifications in this Service Manual are subject to change without notice. Enraf B.V. accepts no responsibility for any errors that may appear in this Service Manual.

*WARNING! Only certified technicians are authorized to make changes on the SmartRadar configuration. All modifications must be in accordance to the guidelines as set forth by Enraf. Modifications not authorized by Enraf will invalidate the approval certificates.*

## 2.5 Labels

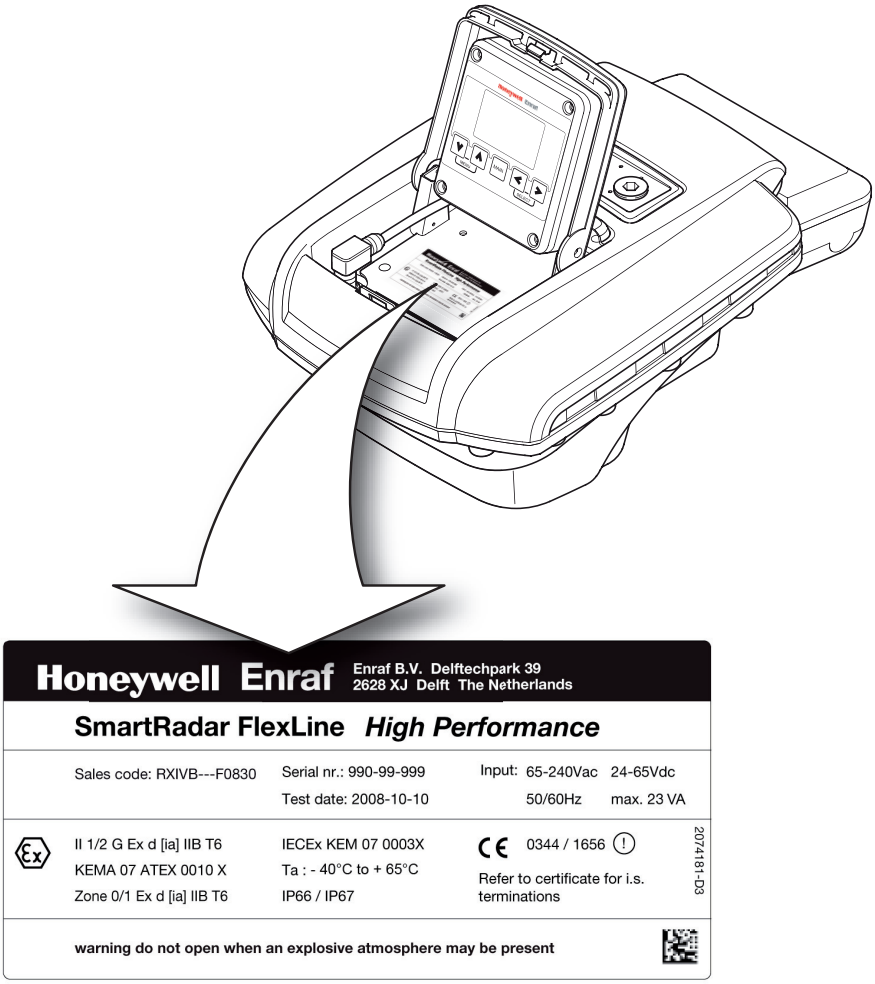

Honeywell Enraf
Enraf B.V. Delftechpark 39
2628 XJ Delft The Netherlands
SmartRadar FlexLine High Performance
Sales code: RXIVB---F0830
Serial nr.: 990-99-999
Test date: 2008-10-10
Input: 65-240Vac 24-65Vdc
50/60Hz max. 23 VA
II 1/2 G Ex d [ia] IIB T6
KEMA 07 ATEX 0010 X
Zone 0/1 Ex d [ia] IIB T6
IECEx KEM 07 0003X
Ta : - 40°C to + 65°C
IP66 / IP67
0344 / 1656
Refer to certificate for i.s. terminations
2074181-D3
warning do not open when an explosive atmosphere may be present

FIGURE 2-1 Identification label with Safety note on the SmartRadar FlexLine

*NOTE: Labels are exemplary and subject to change.*

## 2.6 Personal Safety

*WARNING! National, local and company regulations regarding personal safety must be followed.*

*Pay attention to the kind of product in the tank. If there is any danger for your health, wear a gas mask and take all the necessary precautions.*

*WARNING! Take appropriate precautions when chemical or toxic product vapours are present (compressed air, chemical protection suit, and detection equipment).*

## 2.7 Warnings and Cautions

### 2.7.1 General

#### 2.7.1.1 Opening of the Instrument

*WARNING! DO NOT OPEN WHEN AN EXPLOSIVE ATMOSPHERE MAY BE PRESENT*

When it is required to open the instrument in an explosive hazardous environment, take care of the following:

*WARNING! Make sure that the power to the device is switched off before you open the covers of the device. Failure to do so may cause danger to persons or damage the equipment. All covers of the device must be closed before switching the power on again.*

*WARNING! Treat the flange surface of the cover and the housing with care.*
*Keep the flange surface free of dirt.*
*The O-ring must be present and undamaged.*

#### 2.7.1.2 Closing of the Instrument

Cover flanged joint must be cleaned before closing.

The closing flange bolts of the lid of the SmartRadar FlexLine must be fastened with a torque of 15.5 Nm.

#### 2.7.1.3 Tools

*WARNING! Use non-sparking tools and explosion-proof testers. Use suitable explosion-proof tools (for example, testing devices)!*

#### 2.7.1.4 Working Environment

##### *2.7.1.4.1 Hazardous Area*

*WARNING! Potential Electrostatic Charging Hazard!*

*Avoid generation of static electricity.*

*In case a OneWireless SmartRadar FlexLine is installed, do NOT wipe the surface of the antenna with dry cloth, and do NOT clean its surface with a solvent.*

*If electrostatically charged, discharging of the antenna surface to a person or a tool could ignite a surrounding hazardous atmosphere.*

##### *2.7.1.4.2 Safe Area*

*WARNING! Avoid generation of static electricity. Make sure no explosive gas mixtures are build up in the working area.*

#### 2.7.1.5 Required Skills

*WARNING! The technician must be trained and qualified to safely install equipment in hazardous areas. The technician must work in accordance with national, local and company regulations.*

## 2.8 Commissioning and Maintenance

- The entire installation procedure must be carried out in accordance with national, local, and company regulations.

  The entire electrical installation shall be carried out in accordance with the national requirements for electrical equipment to be installed in hazardous areas.

- All wiring entries must be closed such that the approvals are not invalidated. See the see the Installation Guide for the SmartRadar FlexLine, to make sure that the correct thread type is selected.

  For installations using cable glands, use Ex d compound barrier glands (in case of use with the SmartConn integrated junction box, see below instead).

  Use increased safety (Ex e) cable glands in case a SmartConn box is used.

- Improper installation of cable glands, conduits or stopping plugs invalidates the Ex approval of this device.
- Make sure the housing of the device is properly connected to the ground reference! Make sure that the electrical resistance of the ground connection is below the maximum of prescribed by local requirements!

## 2.9 Accordance to Regulations

### 2.9.1 Explosion Safety

- **ATEX**
  - **FlexLine with Integrated SmartView**
    II 1/2 G Ex d [ia] IIB T4 according to KEMA 07ATEX0010 X
    including Integrated SmartView according to KEMA 07ATEX0011
  - **FlexLine without Integrated SmartView**
    II 1/2 G Ex d IIB T6 or Ex d [ia] IIB T6 according to KEMA 07ATEX0010 X
  - **SmartConn**
    II 2 G Ex e ia IIB T6 or according to KEMA 07ATEX0093
- **ECEx**
  - **FlexLine with Integrated SmartView**
    Zone 0/1 Ex d [ia] IIB T4 according to IECEx KEM 07.0003X

including Integrated SmartView according to IECEx KEM 07.0004

- **FlexLine without Integrated SmartView**
  II 1/2 G  Ex d IIB T6 or Ex d [ia] IIB T6 according to IECEx KEM 07.0003X
- **SmartConn**
  Zone 1 Ex e ia IIB T6 according to IECEx KEM 07.0031

■ **FM**

- **FlexLine with Integrated SmartView**
  Class I, Division 1, Groups C and D, T4, according to 3030575
  including optional Integrated SmartView according to 3030575
- **FlexLine without Integrated SmartView**
  Class I, Division 1, Groups C and D, T6, according to 3030575

■ **CSA**

- **FlexLine with Integrated SmartView**
  Class I, Division 1, Groups C and D, T4, Enclosure 4X, Dual Seal
  Ex d [ia Ga] IIB T4 IP66 / IP67 Ga/Gb, Dual Seal according to 1921040
  including optional Integrated SmartView according to 1921040
- **FlexLine without Integrated SmartView**
  Class I, Division 1, Groups C and D, T6, Enclosure 4X, Dual Seal
  Ex d [ia Ga] IIB T6 IP66 / IP67 Ga/Gb, Dual Seal according to 1921040
- **SmartConn**
  Ex e [ia Ga] IIB T6 IP66 / IP67 Gb, Dual Seal according to 1921040

■ **INMETRO**

- **FlexLine without SmartConn and with Integrated SmartView**
  Ex d [ia Ga] IIB T4 Ga/Gb According to TÜV 13.0977 X
  including optional Integrated SmartView according to TÜV 13.0977 X
- **FlexLine without SmartConn and without Integrated SmartView**
  Ex d [ia Ga] IIB T6 Ga/Gb According to TÜV 13.0977 X
- **FlexLine with SmartConn and with Integrated SmartView**
  Ex d e [ia Ga] IIB T4 Ga/Gb According to TÜV 13.0977 X
  including optional Integrated SmartView according to TÜV 13.0977 X
- **FlexLine with SmartConn and without Integrated SmartView**
  Ex d e [ia Ga] IIB T6 Ga/Gb According to TÜV 13.0977 X

### 2.9.2 Compliance to radio communication equipment approvals

#### 2.9.2.1 R & TTE (Radio & Telecommunication Terminal Equipment)

This device complies with EN 302372 of the R&TTE Directive The device does not cause harmful interference and accepts any interference received.

*WARNING! Changes or modifications made to this equipment not approved by Enraf B.V. invalidate the R&TTE*

#### 2.9.2.2 FCC (Federal Communication Commission)

FCC information:

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

1. This device may not cause harmful interference, and 2. This device must accept any interference received, including interference that may cause ndesired operation.

*NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation.*

2. This equipment generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:
   - Reorient or relocate the receiving antenna.
   - Increase the separation between the equipment and receiver.
   - Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
   - Consult the dealer or an experienced radio/TV technician for help.

*CAUTION! Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.*

#### 2.9.2.3 IC (Industry Canada)

Industry Canada Statement:

This device complies with RSS-210 of the Industry Canada Rules. Operation is subject to the following two conditions:

1. This device may not cause interference and
2. This device must accept any interference, including interference that may cause undesired operation of the device.

This class B digital apparatus complies with Canadian ICES-003

Cet appareil est conforme à la norme CNR-210 des règlements d'Industrie Canada. Son fonctionnement est sujet aux deux conditions suivantes:

1. Cet appareil ne doit pas provoquer d'interférences et
2. Cet appareil doit accepter toutes les interférences, y compris celles pouvant entraîner son dysfonctionnement.

Cet appareil numérique de la classe B est conforme à la norme NMB-003 du Canada.

*NOTE: This device is certified to measure liquid levels in metal, concrete or similar materials, enclosed tanks*

*NOTE: The radiated output power of the device is far below the exposure limits. Nevertheless, use the device in such a manner that the potential for human contact during normal operation is minimal.*

### 2.9.3 EN302372-1 ANNEX B

The following installation requirements shall be fulfilled:

1. SmartRadar FlexLine instruments are required to be installed at a permanent fixed position at a closed (not open) metallic tank or reinforced concrete tank, or similar enclosure structure made of comparable attenuating material.
2. Flanges and attachments of the radar equipment shall provide the necessary microwave sealing by design.
3. Sight glasses shall be coated with a microwave proof coating when necessary (i.e. electrically conductive coating).
4. Manholes or connection flanges at the tank shall be closed to ensure a low-level leakage of the signal into the air outside the tank.
5. Whenever possible, mounting of the radar equipment shall be on top of the tank structure with the orientation of the radar antenna to pointing in a downward direction.

*NOTE: Do not rub the radio antenna to prevent sparks or otherwise create electrostatic charge. Risk of explosion.*

6. Installation and maintenance of the radar equipment shall be performed by professionally trained individuals only.

### 2.9.4 Low-Voltage Directive

The device is suitable for the following:

- Pollution degree 2
- Overvoltage category II
- Class I equipment

# CHAPTER 3 SYSTEM ARCHITECTURE

## 3.1 SmartRadar FlexLine Architecture for R120 and R220

The SmartRadar FlexLine system is built up from interchangeable hardware modules. These modules consist of uniform printed circuit boards (PCBs), each of them representing a different, unique functionality. Together with the software implemented on these hardware parts, each PCB makes up a FlexConn module. These modules communicate with each other through the serial CAN-bus on the DIN rail backplane - on which they are mounted - or wireless by using the OneWireless Network option. See FIGURE 3-1 for R120 and See FIGURE 3-2 for R220.

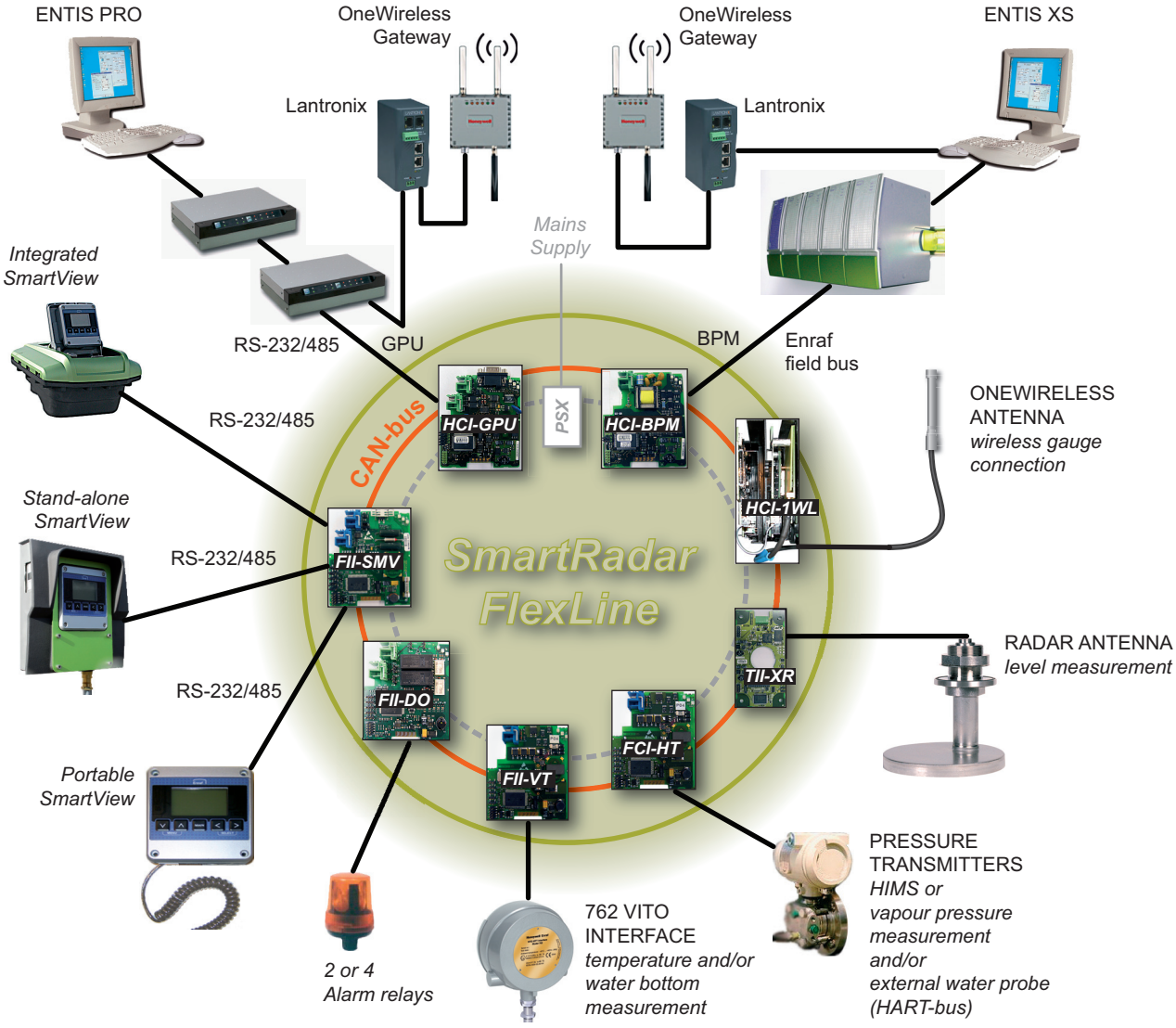



FIGURE 3-1 SmartRadar FlexLine system architecture overview for R120

ESF07-0026

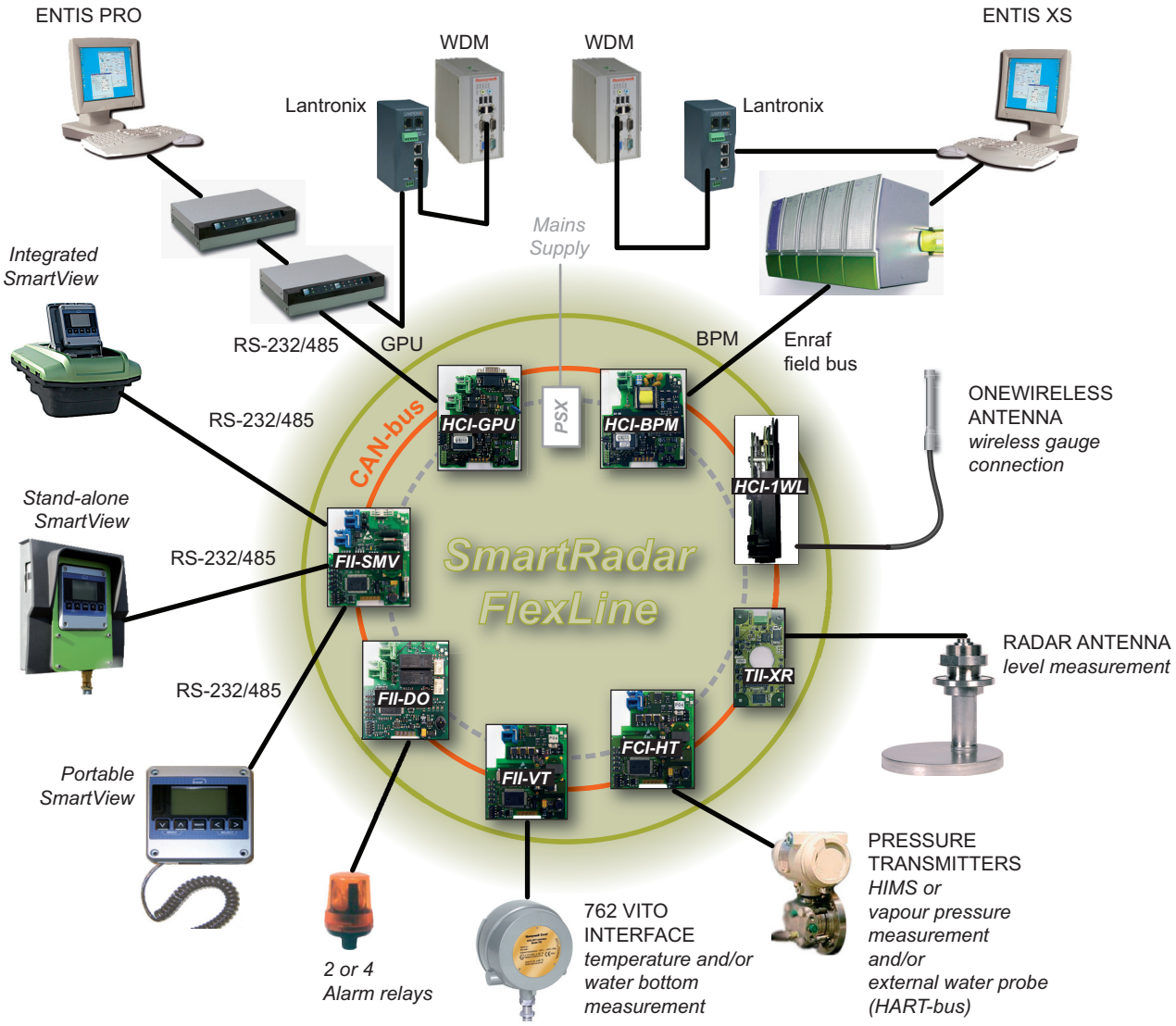



FIGURE 3-2 SmartRadar FlexLine system architecture overview for R220

## 3.2 FlexConn Modules

One of the main characteristics of the SmartRadar FlexLine architecture is its placement flexibility of the FlexConn modules. Any types of modules can be added at any locations. Two identical modules can also be placed in the SmartRadar FlexLine system.

Each FlexConn module has one or more functions. In general, this can be a *sensor* function, a *communication* function, or a *digital-interface* function.

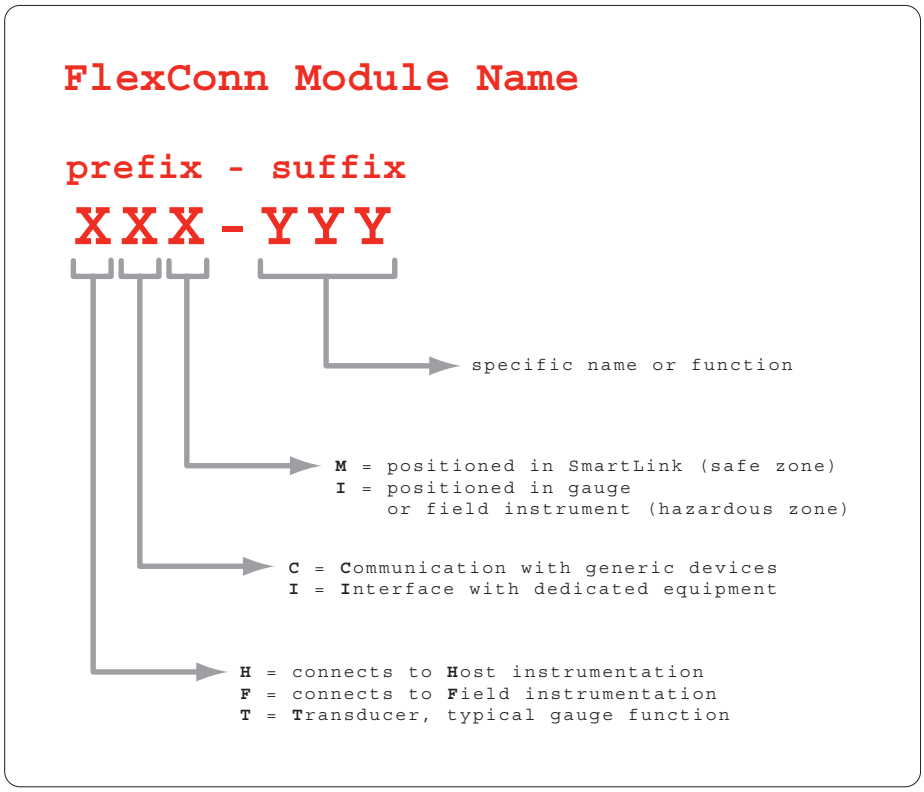
A *sensor* function measures or calculates a process value, or it obtains a process value from a connected external instrument.

A *communication* function ensures communication with a communication interface unit or with a DCS, SCADA, tank inventory, or another terminal automation system.

A *digital-interface* function controls digital output or reads digital input from instruments around the storage tank.

*NOTE: Some FlexConn PCBs are also used in the SmartLink system.*

Each FlexConn module has a unique name, which is built according to the following image:


FlexConn Module Name
prefix - suffix
XXX-YYY
specific name or function
M = positioned in SmartLink (safe zone)
I = positioned in gauge
or field instrument (hazardous zone)
C = Communication with generic devices
I = Interface with dedicated equipment
H = connects to Host instrumentation
F = connects to Field instrumentation
T = Transducer, typical gauge function

Each FlexConn PCB consists of a *generic* and a *specific* electronic part. The generic part can be found on any FlexConn modules. The specific electronics part represents an application-specific function. See FIGURE 3-3.

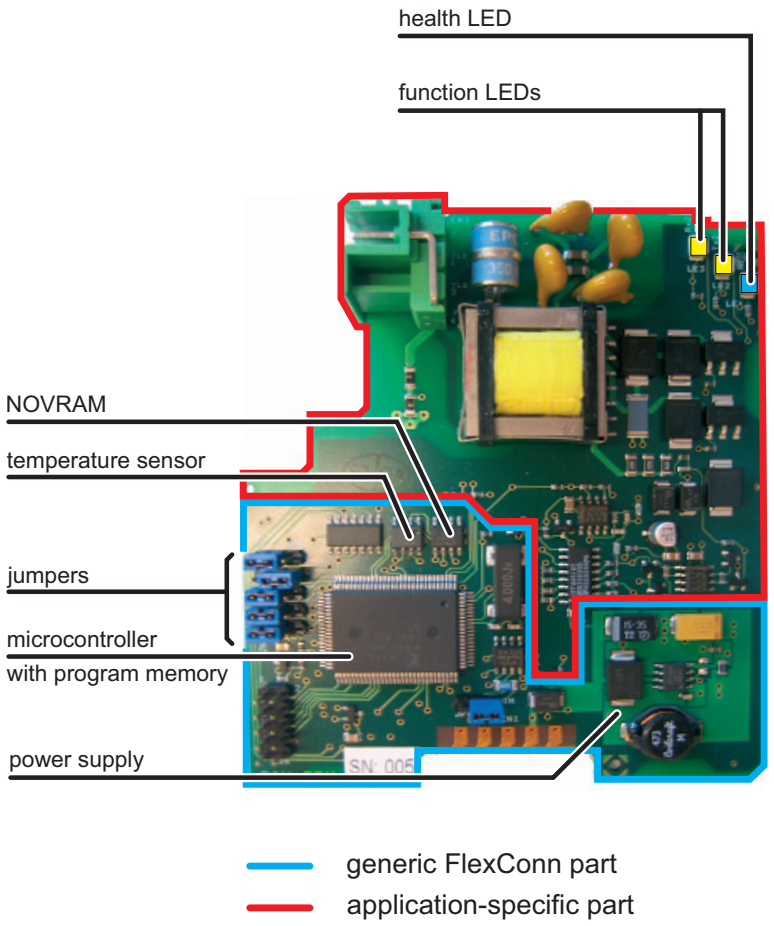



FIGURE 3-3 A typical FlexConn PCB layout

ESF07-0021

The following parts are available on the *generic* electronics part.

- **The program memory**

This memory contains the module-specific software.

- **The microprocessor / controller**

The microprocessor executes the module-specific software stored in the program memory.

- **The non-volatile memory**

The commissioning parameters and the diagnostics data are stored when the power is switched off.

### ■ Jumpers:

With the jumpers, specific hardware settings can be made:

| Jumper Number | Function |
|---|---|
| 1 | All warning and monitoring-related commissioning entities[a] are protected and cannot be changed |
| 2 | The password is protected from being read |
| 3 | All commissioning entities are protected and cannot be changed |
| 4 | Board-specific jumper |
| 5 | Board-specific jumper |

a) For an explanation of the *entities* concept, see see 3.3 "Entities" on page 8.

### ■ Health LED

The Health LED (= LE1, the blue circle) indicates the general health status of the FlexConn module.

| Health Status | Flashing Pattern |
|---|---|
| Good | |
| Uncertain | |
| Bad | |

### ■ 2 function LEDs

These LEDS indicate module-specific activities, such as for instance data being transmitted or received.

## ■ 3 voltage monitors

The output of these monitors, being voltage levels from three different FlexConn PCB locations, are used for diagnostics purposes.

See FIGURE 3-4.

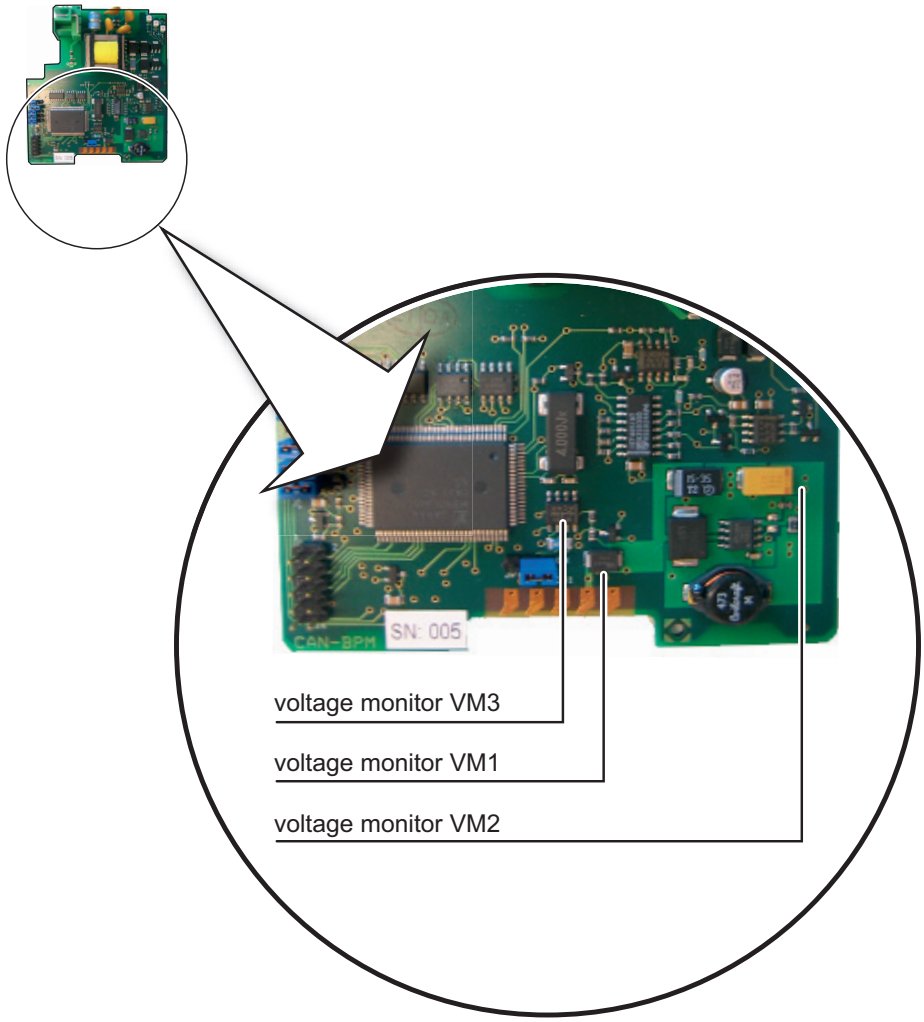



FIGURE 3-4 Locations of the 3 voltage monitors

ESF07-0023

## ■ 1 temperature sensor

For the operational PCB, this sensor acts as an input for environmental-temperature diagnostics. The PCB's environmental temperature is used as a measure for the temperature inside the SmartRadar FlexLine.

## 3.3 Entities

Information exchange between the various FlexConn modules takes place by means of the *entities*.

An *entity* represents a unique information association in the FlexConn architecture. This information may consist of measuring data, status data, commissioning parameters, diagnostics data, or commands.

In addition to the information exchange between FlexConn modules, entities are used for data presentation on the SmartView display, and for the communication between the Engauge service tool and the SmartRadar FlexLine.

The entities are represented by a textual description, for example, “Reset”, “Tank bottom”, “Health”, or “Baudrate”.

The entities structure is related to the following:

- General status information
- Generic FlexConn part
- Function-specific FlexConn part

### 3.3.1 Status Entities

The “Health” and “Commissioned” entities provide information about the general FlexConn module status and the functions implemented on this module.

#### 3.3.1.1 Health Entity

The “Health” entity reflects the condition of the entire module, each single module function, and the calculated or measured value of a sensor function.

The “Health” entity structure is defined by following items:

1. status
2. status category
3. status code

The *status* field gives high-level information:

- good
- uncertain
- bad

The following table provides information about the *status category* that is, the general reason *why* the status is good, uncertain, or bad.

| Status | Status Category |
|---|---|
| Good | actual |
| | manual |
| | last valid |
| | stored |
| Uncertain | instrument |
| | environment |
| Bad | general hardware fail |
| | general firmware fail |
| | general commissioning fail |
| | general calibration fail |
| | general operational fail |
| | over range (data available!) |
| | under range (data available!) |
| | no data available |
| | un-initialized |
| | killed |

The following tables provides information about the *status code* and the *specific reason* why the status is good, uncertain, or bad. This information is presented as an information number coupled with a textual description of this specific situation.

| Good | | | | | | | | Uncertain | | | | | | Bad | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| actual | | manual | | last valid | | stored | | instrument | | | environment | | | un-init | killed | no data | under range | over range | hw fail | sw fail | cal fail |
| 001 | 056 | 077 | 104 | 632 | 328 | 207 | 782 | 065 | 478 | 199 | 389 | 011 | 072 | ..... | | | | | | | |

- Each ***board*** implements “health” as generic information based on the function (s) health(s).
- Each ***function*** implements “health” as generic information.
- Each ***sensor*** and ***digital I/O*** function implements an entity called “Primary Value”, which in addition to the actual measured value also contains a “health” status.

#### 3.3.1.2 Commissioned Entity

The “Commissioned” entity informs the end user if the most important commissioning entities of the concerned FlexConn module and its implemented functions are set correctly.

- True = the most important entities are set correctly
- False = the most important entities are ***not*** set correctly

### 3.3.2 Generic Entity

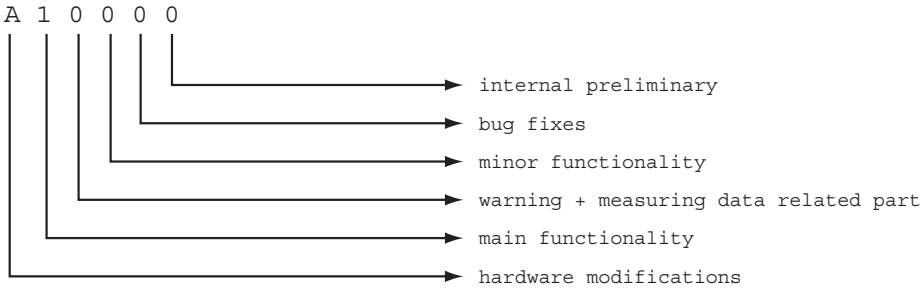
The following command entities are implemented as generic functions.

- “Reset device”
- “Reset board”

The following information is available through the entities.

- “Board name” = FlexConn module name
- “Board hardware version” = Hardware version of the FlexConn PCB
- “Firmware version” = Version of the software running on the FlexConn module

The firmware (software) version data is built up according to the format below:




The last digit is not shown in the official or formal releases.

### 3.3.3 Function-specific Entities

For the function-specific entities, see chapter 7 "Commissioning".

## 3.4 SmartView Display

### 3.4.1 General

The SmartView is used to set and control most of the FlexConn module settings.

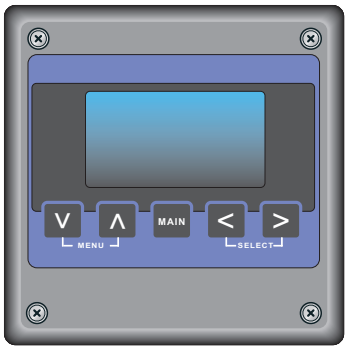



FIGURE 3-5 An impression of the SmartView ESF07-0024

For each *sensor* and *digital I/O* function implemented on a FlexConn module, a Primary Value screen is available on the *SmartView* display.

In the left bottom quarter of the display, the Primary Value's "Health" status is displayed.

| Status | Display Text |
|---|---|
| Good | |
| Uncertain | uncertain |
| Bad | bad |

Below the Status field, the Status category is displayed:

| Status Category | Display Text |
|---|---|
| actual | |
| manual | manual |
| last valid | last valid |
| stored | stored |
| instrument | instrument |
| environment | environment |
| general hardware fail | hardware |
| general firmware fail | software |
| general commissioning fail | commission |
| general calibration fail | calibration |
| general operational fail | operational |

| Status Category | Display Text |
|---|---|
| over range | over range |
| under range | under range |
| no data available | no data |
| un-initialized | no init |
| killed | killed |

### 3.4.2 Status Entities on SmartView

Select sub-menu “commissioning” from the main menu to view the survey results of all FlexConn modules present in the SmartRadar FlexLine system.

Each module is followed by an indication for the “**H**ealth” and the “**C**ommissioned” status respectively. In case of an unreliable or fault situation, the “**I**nformation” column displays an information code in addition. This information code reveals the specific reason about the current status.

This diagnostics is available for each individual FlexConn module. See example below.

```
            H C I
FII-DO      G N
```

- The “Health” indication is as follows:

“G” = Good

“U” = Uncertain

“B” = Bad

- The “Commissioned” indication is as follows:

“Y” = the most important entities are set correctly

“N” = the most important entities are ***not*** set correctly

Starting from the “commissioned” menu and selecting the specific FlexConn module, the above diagnostics is repeated for each module *function*. See example below.

```
FII-DO:>
board       H C I

Relay 1     G N
Relay 2     G Y
Relay 3     U Y nnn
Relay 4     B Y
```

### 3.4.3 Generic Entities on SmartView

From the functions survey screen of the concerning FlexConn module, the generic entity commands or the commissioning entity can be selected through the “board” entry.

```
FII-DO:>
board        H C I

Relay 1      G N
Relay 2      G Y
Relay 3      U Y nnn
Relay 4      B Y
```

### 3.4.4 Specific Entities on SmartView

Selecting a specific function, for instance, “Relay 2”, gives access to the specific entities for this function.

The specific entities are described in chapter 7 "Commissioning".

## 3.5 Engauge Service Tool

The Engauge service tool is a computer application in which all the FlexConn module settings can be performed.

Using the Engauge's explorer, double-click on the module's icon to individually select each FlexConn module of the SmartRadar FlexLine. The "board descriptor" is loaded which results in a screen with "tab" pages. Select these tab pages, to set the specific module details.

See FIGURE 3-6 for an example of an Engauge tool.

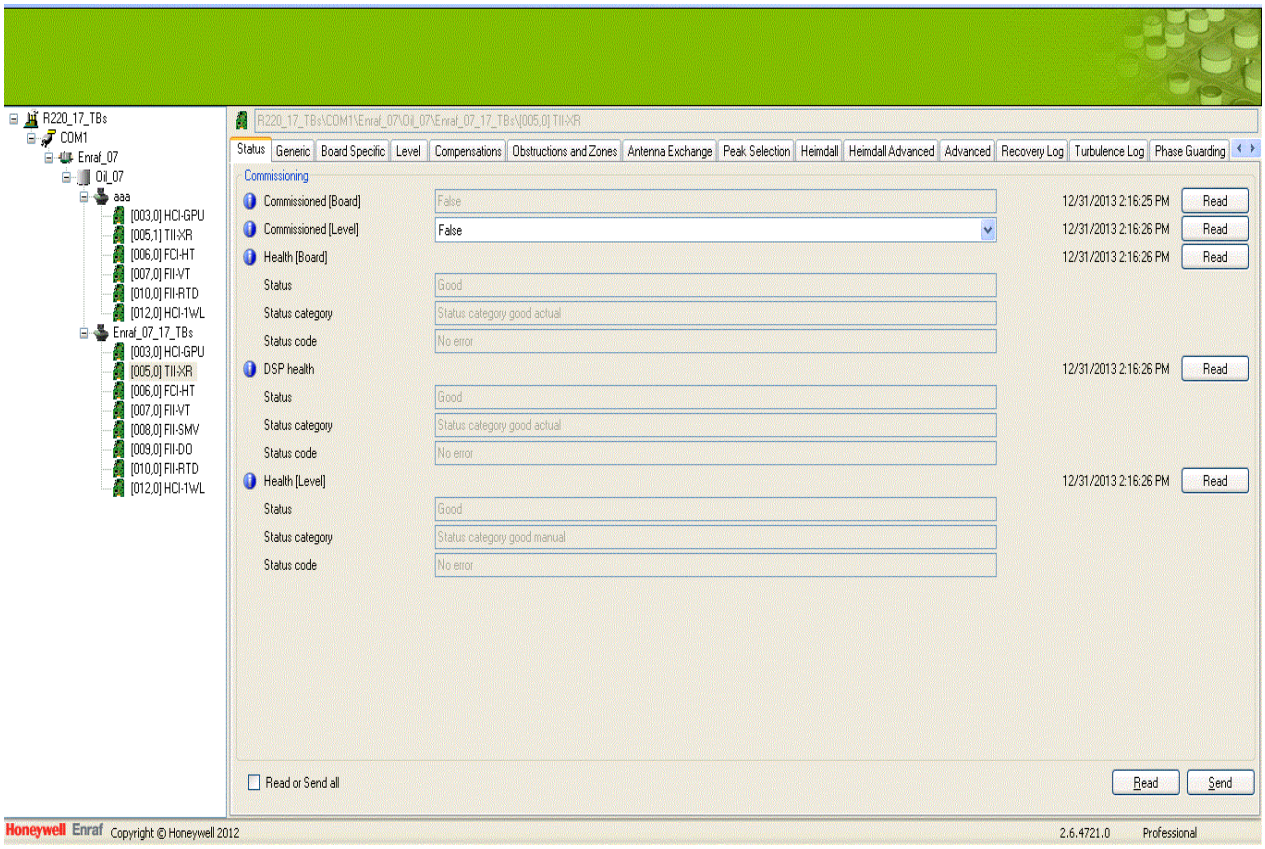



FIGURE 3-6 Example of an Engauge screen

ESF09-0001

### 3.5.1 Status Entities in Engauge

Each board descriptor user interface starts with the tab page “Status”. In this tab page the “Health” and “Commissioning” entities for the complete module and the individual functions are placed.

### 3.5.2 Generic Entities in Engauge

The “Status” tab page is always followed by the “Generic” tab page, in which the general commands and diagnostics entities are placed.

### 3.5.3 Board-specific Entities in Engauge

The “Generic” tab page is always followed by the “Board specific” tab page, in which the board-specific entities are placed. These entities are specific for each individual FlexConn module type. The board-specific entities are further described in *Chapter 6 - Commissioning*.

### 3.5.4 Specific Entities on Engauge

After the board-specific tab page, for each implemented function on the concerned FlexConn module a specific tab page follows.

For example, for the FII-DO module, the below listed specific tab pages are present:

- Relay 1
- Relay 2
- Relay 3
- Relay 4

In case of complex functions, extra tab pages can exist, containing the specific functions involved.

The specific entities are described in chapter 7 "Commissioning".

### 3.5.5 Function-generic Entities on Engauge

The function category “generic entities” are placed at the bottom of each function tab page in Engauge.

For each category (sensor, digital I/O, communication, display), the basic Engauge version contains only one entity:

“Function identification”.

With this entity, you can change the function name, which is available on the SmartView Primary Value screen and in Engauge.

# CHAPTER 4 SERVICE TOOLS

## 4.1 SmartView

### 4.1.1 General

The *SmartView* is the basic tool in which you can communicate with the SmartRadar FlexLine modules.

Open keyboard contacts may be dangerous in an explosion-hazardous environment. The *SmartView* is built up as a totally shielded explosion-safe tool.

### 4.1.2 SmartView Versions

The *SmartView* can be delivered in three versions:

- *SmartView* fixed on the instrument
- *SmartView* as a tank-side indicator (stand-alone)
- A portable *SmartView*

fixed on the instrument | as a tank-side indicator | as a portable tool

FIGURE 2-1 The 3 different SmartView options ESF07-0027

### 4.1.3 Connections

Within a hazardous environment, connecting or disconnecting electrical equipment is dangerous, because of the sparking risks.

The **portable** *SmartView* however is designed such that it **may be connected/disconnected within a hazardous zone**.

The **fixed** version *SmartViews* (integrated within the instrument or tank-side mounted) contain pre-installed fixed connections.

### 4.1.4 SmartView Controls

The SmartView has 5 push buttons and an LCD-screen with a backlight that can be switched on/off as desired. By using the menu, the SmartRadar FlexLine control operations can be performed.

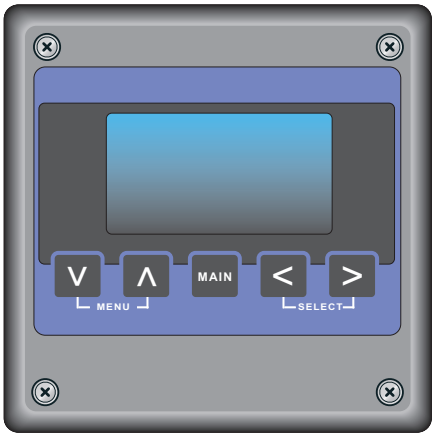



FIGURE 2-2 The SmartView controls ESF07-0024

The following table provides the functions of the buttons available on the SmartView:

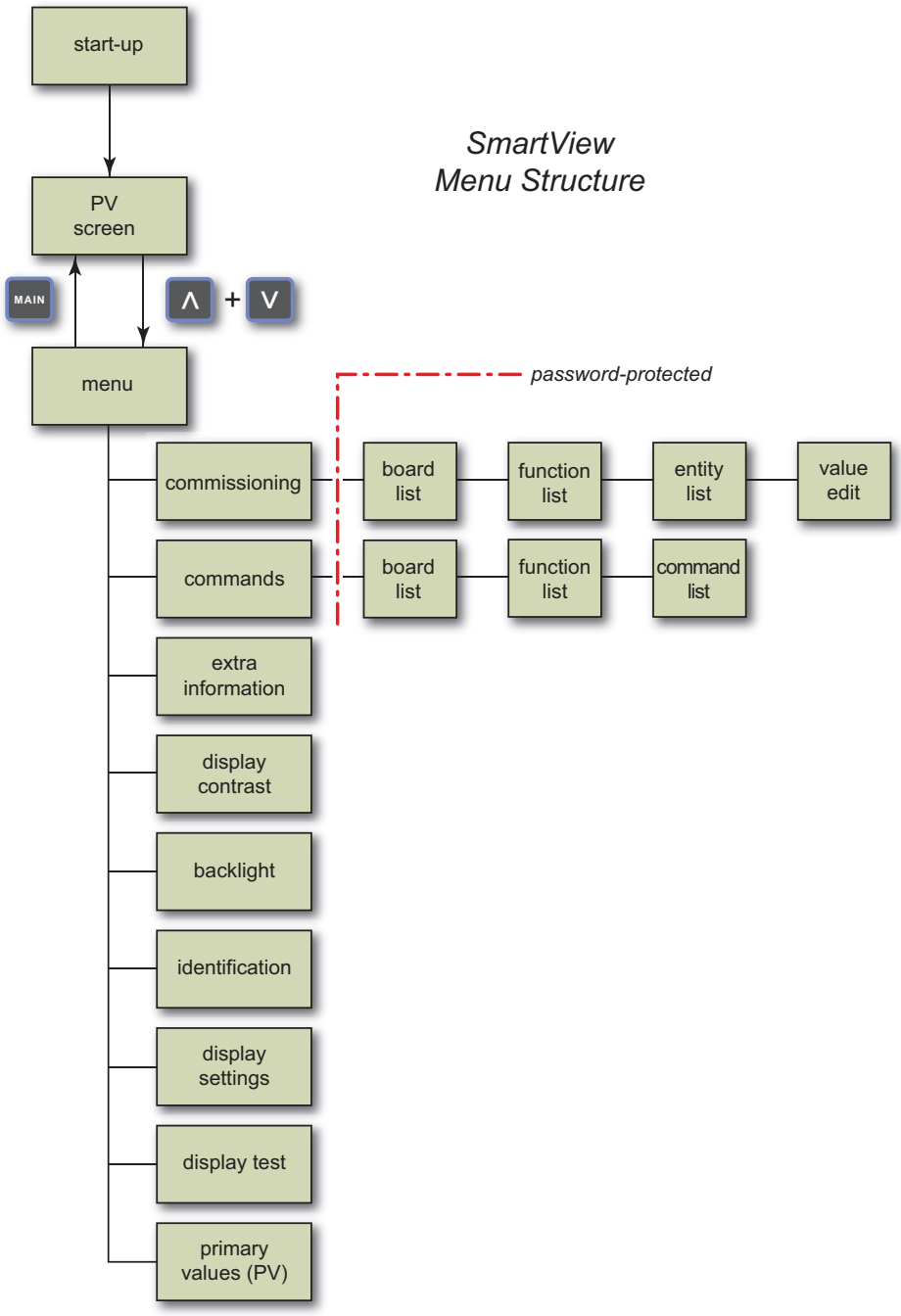
| Button | Function *within menu ...* | |
|---|---|---|
| > | PV | Go to next PV screen |
| | Commissioning | Move cursor 1 position to the right |
| | Display contrast | Increase contrast |
| | Backlight | Toggle between ON and OFF |
| | Display settings | Toggle between ON and OFF |
| < | PV | Go to previous PV screen |
| | Commissioning | Leave current menu screen, and go to higher-level menu.<br>*Important: Leaving an edit screen this way will undo all editing!* |
| | Commands | Leave current menu screen, and go to higher-level menu. |
| | Display contrast | Decrease contrast |
| | Backlight | Toggle between ON and OFF |
| | Display settings | Toggle between ON and OFF |
| < + > | Commissioning | Confirm selected choice |
| | Commands | Confirm selected choice |

| Button | Function *within menu ...* | |
|---|---|---|
| ∧ | Commissioning | Within the *menu* screens, move cursor 1 line up<br>Within the *edit* screens, scroll characters as long as the button is pressed |
| | Commands | Move cursor 1 line up |
| | Display settings | Toggle between *Main screen* and *Standby* mode |
| | Identification | Go to next identification screen |
| ∨ | Commissioning | Within the *menu* screens, move cursor 1 line down<br>Within the *edit* screens, scroll down 1 character |
| | Commands | Move cursor 1 line down |
| | Display settings | Toggle between *Main screen* and *Standby* mode |
| | Identification | Go to next identification screen |
| ∧ + ∨ | Show menu | |
| MAIN | Go to PV screen | |
| ∨ + < | Decrease contrast | |
| ∨ + > | Increase contrast | |
| ∧ + > | Standby mode - Pressing any buttons will activate SmartView again | |

### 4.1.5 SmartView Menu Structure

#### 4.1.5.1 SmartView Screens

Depending on the state of the menu process and the pressed button(s), the following screens can be displayed.




ESF07-0043

#### 4.1.5.1.1 Start-up Screen

The *SmartView* starts up displaying the following:

1. Black test
2. Blank test
3. Enraf logo + software version + tank ID
4. PV screen

#### 4.1.5.1.2 Menu Screen

By using the [menu] screen of the *SmartView* (see FIGURE 2-3) you can *view and/or modify settings*, or you can *send a specific command* to a sensor or a digital I/O board.

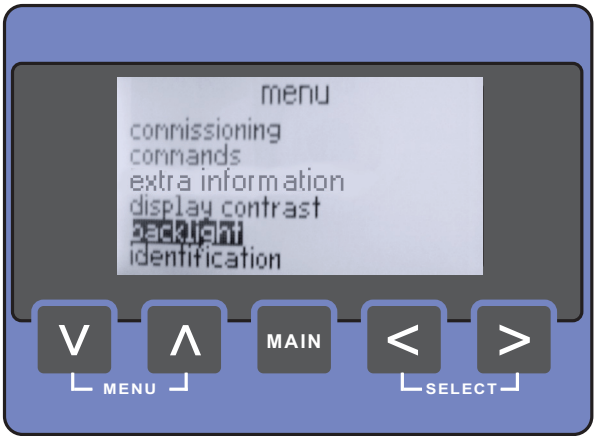



FIGURE 2-3 The menu screen ESF07-0030

| Menu Item | Description |
|---|---|
| [menu] | Screen title. |
| [commissioning] | Configuration parameters can be set |
| [commands] | Allows you to send a command to a sensor or digital I/O board |
| [display contrast] | Allows you to adjust the display contrast |
| [backlight] | Allows you to switch ON or OFF the backlight |
| [identification] | Displays information about the following:<br>• Tank name<br>• Tank address<br>• Customer ID<br>• SmartView software version<br>• SmartView address<br>• FlexConn module name, board ID, board instance, and software version |

| Menu Item | Description |
|---|---|
| [display settings] | Allows you to switch ON/OFF buttons time-out:<br>• Main screen: If the button is not pressed within 15 minutes, *SmartView* switches to PV screen<br>• Standby mode: If the button is not pressed within 15 minutes, *SmartView* switches to standby mode |
| [display test] | Performs blank/black test. |
| [extra information] | The [extra information] screen displays information about a specific function. See also 4.1.5.1.8. |

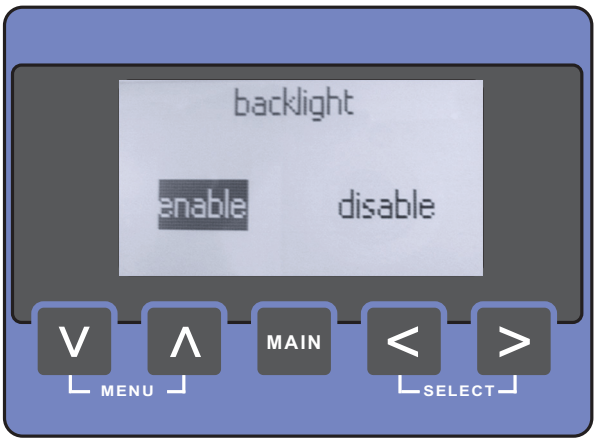
TABLE 6-1 The menu items

#### *4.1.5.1.3 Backlight Screen*

The [backlight] screen (see FIGURE 2-4) allows you to *enable/disable the backlight*. The *SmartView* only turns the backlight ON if following conditions are met:

- [backlight] is enabled by the host
- [backlight] is enabled by the user

When the left or right button is pressed, the backlight settings immediately changes. The backlight setting is stored in non-volatile memory.




ESF07-0031

FIGURE 2-4 The backlight screen

#### 4.1.5.1.4 *Display Contrast Screen*

The [display contrast] screen (see FIGURE 2-5) displays a horizontal scroll bar. By moving the scroll bar, you can *adjust the contrast*. Moving to the right immediately increases the contrast, moving to the left decreases the contrast.

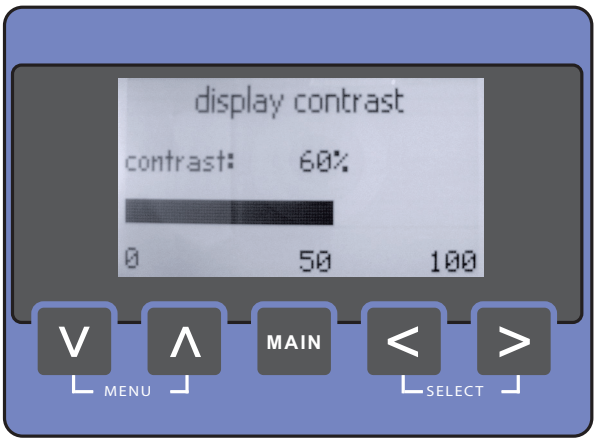



FIGURE 2-5 The display contrast screen ESF07-0032

#### 4.1.5.1.5 *Display Settings Screen*

The [display settings] screen allows you to *set the time-outs* for the *buttons*. The screen displays the following items:

| Feature | Possible States | Default |
|---|---|---|
| Buttons time-out to main screen | ON/OFF | ON |
| Buttons time-out to standby mode | ON/OFF | ON |

#### 4.1.5.1.6 *Display Test Screen*

When the [display test] screen is selected, *the SmartView* performs a *black/blank test*. SmartView begins drawing a rectangle of 64 x 128 pixels, filled with black pixels for a period of 2s. After that period, the screen is cleared using a rectangle filled with white pixels for a period of 2s.

#### 4.1.5.1.7 *Identification Screen*

The [identification] screen (see examples in FIGURE 2-6) allows you to *scroll through the available FlexConn modules*, using the up and down buttons, to obtain information regarding the following:

- SmartView (see left screen)
  - the tank name
  - the tank address
  - software version
  - SmartView address
  - customer ID
- FlexConn modules (see right screen)
  - board name
  - board id
  - instance
  - software version

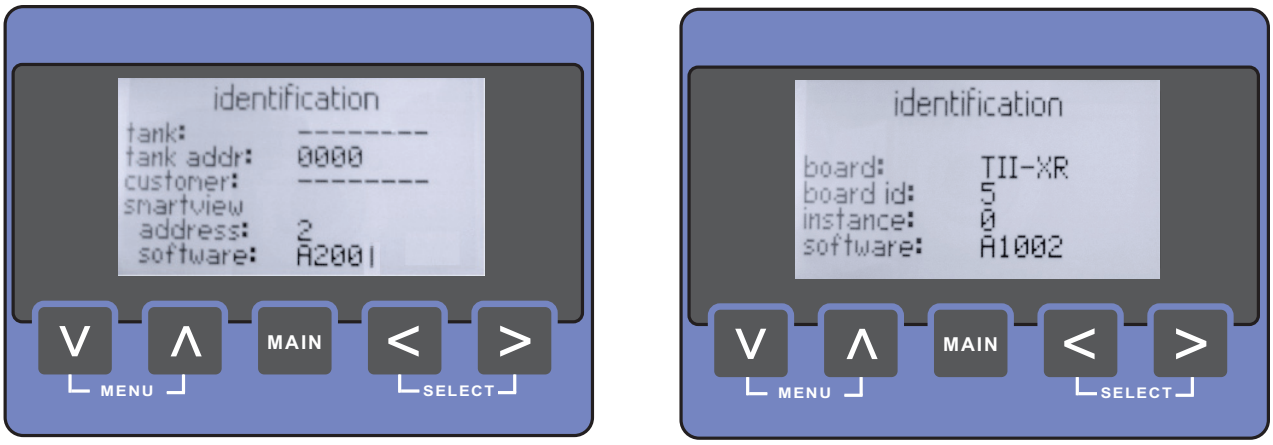



FIGURE 2-6 Identification screen examples

ESF07-0033 + 0029

#### *4.1.5.1.8 Extra Information Screen*

The [extra information] mode can be configured to display either the [level & temperature] screen or the [extra information] screen (see FIGURE 2-7). The [extra information] screen *displays information* about a specific function. The specific functions are described in CHAPTER 7. The [level & temperature] screen (see FIGURE 2-7) *displays information* about the measured product level and temperature. In this menu mode, it is *not* possible to change any settings.

NOTE: *In case of an error situation, the level fields are filled with "#" and the temperature fields with "9".*

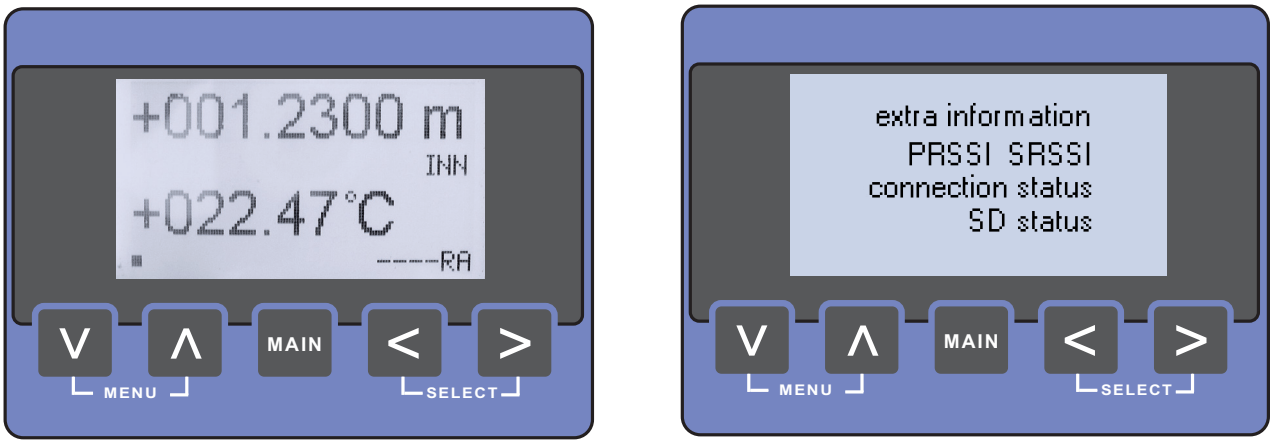



FIGURE 2-7 The level & temperature screen (left) and the extra information screen (right) ESF07-0039/0012

#### 4.1.5.1.9 *Primary Value Screen*

The [Primary Value] screen (PV-screen), displayed in FIGURE 2-8, depicts information about data measured by a sensor, or information about the status of a digital I/O. See table TABLE 6-2.

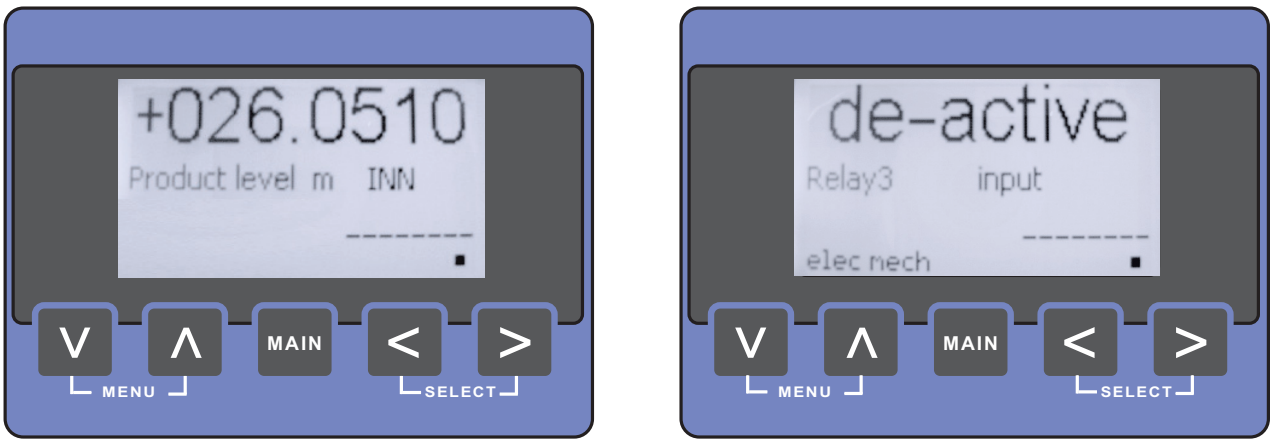



FIGURE 2-8 PV-screen examples (left: level status, right: digital I/O status) ESF07-0028 + 0044

| Data Field | Max. Size [characters] | Description |
|---|---|---|
| Primary Value | 9 | The measured value, for example, +025.1277 |
| PV identification | 13 | Quantity name, for example,<br>• Product level<br>• Product temperature<br>• P1 pressure |
| PV units | 5 | Quantity unit, for example<br>• m<br>• kg/m$^3$<br>• kPa |
| PV type | 3 | Type can be:<br>• INN (innage)<br>• ULL (ullage)<br>• REL (relative)<br>• ABS (absolute) |
| PV health | 9 | Status of the Primary Value:<br>• UNCERTAIN<br>• BAD |

| Data Field | Max. Size [characters] | Description |
|---|---|---|
| PV representation | 15 | Representation of the PV:<br>• Manual<br>• Last valid<br>• Stored<br>• Instrument<br>• Environment<br>• Hardware<br>• Software<br>• Commission<br>• Calibration<br>• Operational<br>• No data<br>• No init.<br>• Killed<br>• Over range<br>• Under range |
| PV alarms | 9 | Alarm type that occurred:<br>• High High<br>• High<br>• Low<br>• Low Low |
| Tank identification | 8 | Tank name, for example, CRUDE 07 |
| Alive indicator | 1 | Blinking cursor (bottom right) indicates PV being updated |

TABLE 6-2 Primary Value (PV) items

REMARKS:
1. In error situation, the data fields are filled with “#”.
2. *SmartView* enters standby mode when the communication with the host is lost.
3. The data fields PV health, PV representation, and PV alarms are only visible if they are applicable.

#### *4.1.5.1.10 Password Screen*

The [commands] and [commissioning] menus are password-protected. The [password] screen (see FIGURE 2-9) appears when you enter the [commands] or the [commissioning] menu.

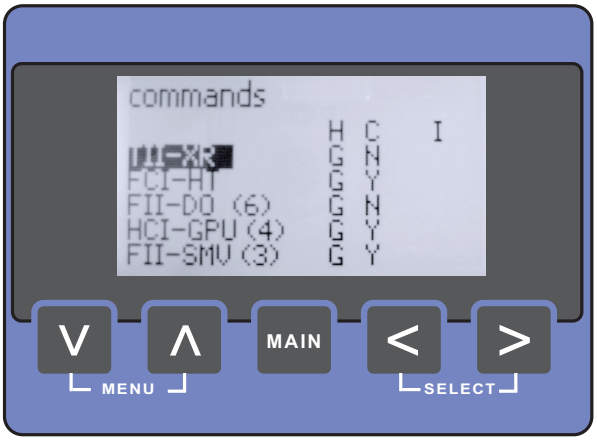
When the password is entered correctly (only once for both menu entries), you can change the values. 15 minutes after the last button is pressed, the password needs to be re-entered.

ESF07-0040

FIGURE 2-9 The password screen

#### *4.1.5.1.11 Commands Menu Screens*

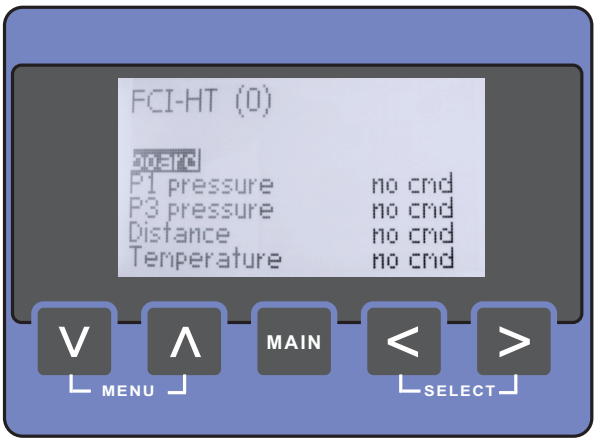
- The [commands] menu starts with the [board list] screen (see FIGURE 2-10).
  You can *navigate through the board list* by using the up and down buttons. A board can be selected by simultaneously pressing the left + right button.




ESF07-0034

FIGURE 2-10 The board list screen

- The [function list] screen (see FIGURE 2-11) displays all the *available functions* of the previously selected board. You can navigate through the function list by using the up and down buttons. You can return to the [board list] screen by pressing the left button. A function can be selected by simultaneously pressing the left + right button. If a FlexConn module does *not* contain any function commands, this is indicated in the list (<no cmd>).

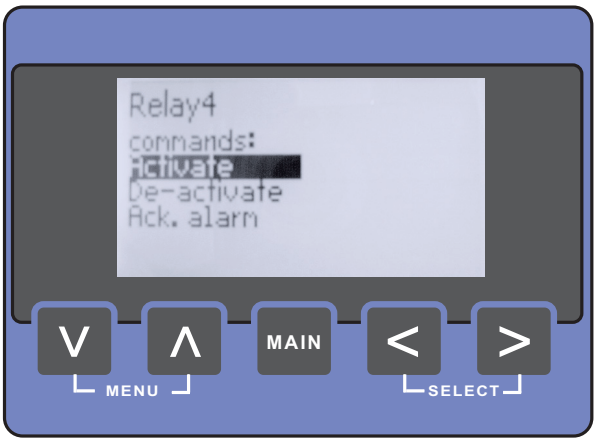



ESF07-0045

FIGURE 2-11 The function list screen

- When an available function is selected, the [command list] screen is presented (see FIGURE 2-12). You can navigate through the

function list by using the up or down button. A command can be selected by simultaneously pressing the left + right button. You can return to the [function list] screen by pressing the left button.

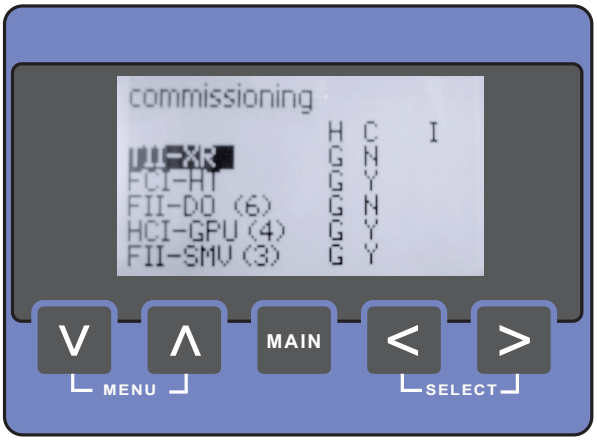



ESF07-0035

FIGURE 2-12 The command list screen

#### *4.1.5.1.12 Commissioning Menu Screen*

- The [commissioning] menu starts with the [board list] screen (see FIGURE 2-13).
  You can *navigate through the board list* by using the up or down button. A board can be selected by simultaneously pressing the left + right button.




ESF07-0036

FIGURE 2-13 The board list screen (commissioning)

- The [function list] screen (see FIGURE 2-14) *displays all configurable entities* of a function.
  The actual entity value is also visible.
  You can *navigate through the board list* by using the up or down button. A function can be selected by simultaneously pressing the left + right button. You can return to the [board list] screen by pressing the left button.

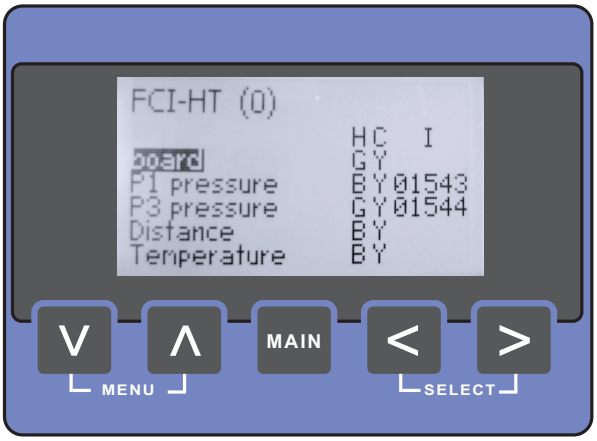



FIGURE 2-14 The function list screen (commissioning) ESF07-0046

- On selection of an available function, the [entity list] screen is presented (see FIGURE 2-15). You can *navigate through the entity list* by using the up or down button. An entity can be selected by simultaneously pressing the left + right button. You can return to the [function list] screen by pressing the left button.

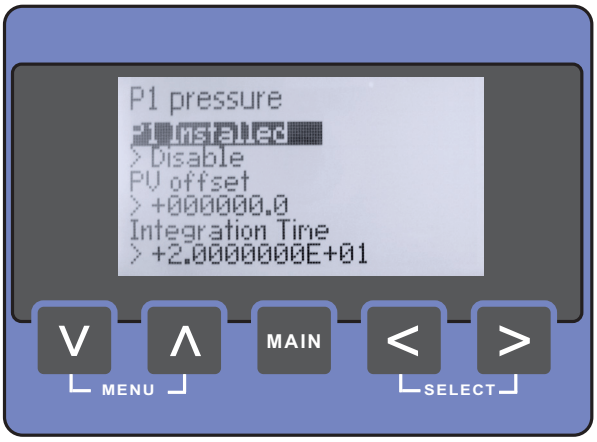



FIGURE 2-15 The entity list screen ESF07-0047

- On selection of an available entity, the [value edit] screen is presented (see FIGURE 2-16).
  - If an *invalid* value is entered, the message “value out of range” is displayed.
  - If the value is *not accepted* by the FlexConn module, the message “value not accepted” is displayed.
  - You can scroll along the characters by push and hold the up button.
  - An entity modification is only executed on simultaneously pressing the left + right button. After this, first a range check is performed. If the modification is accepted, you return to the [value edit] screen.
  - The cursor can be shifted to the right by pressing the right button.
  - You can return to the [entity list] screen by pressing the left button.

NOTE: *Use the left button to return to the [entity list] screen **without executing** the modification(s). Press the left + right button simultaneously to undo this (these) modification(s)!*

FIGURE 2-16 Examples of the value edit screen

ESF07-0037

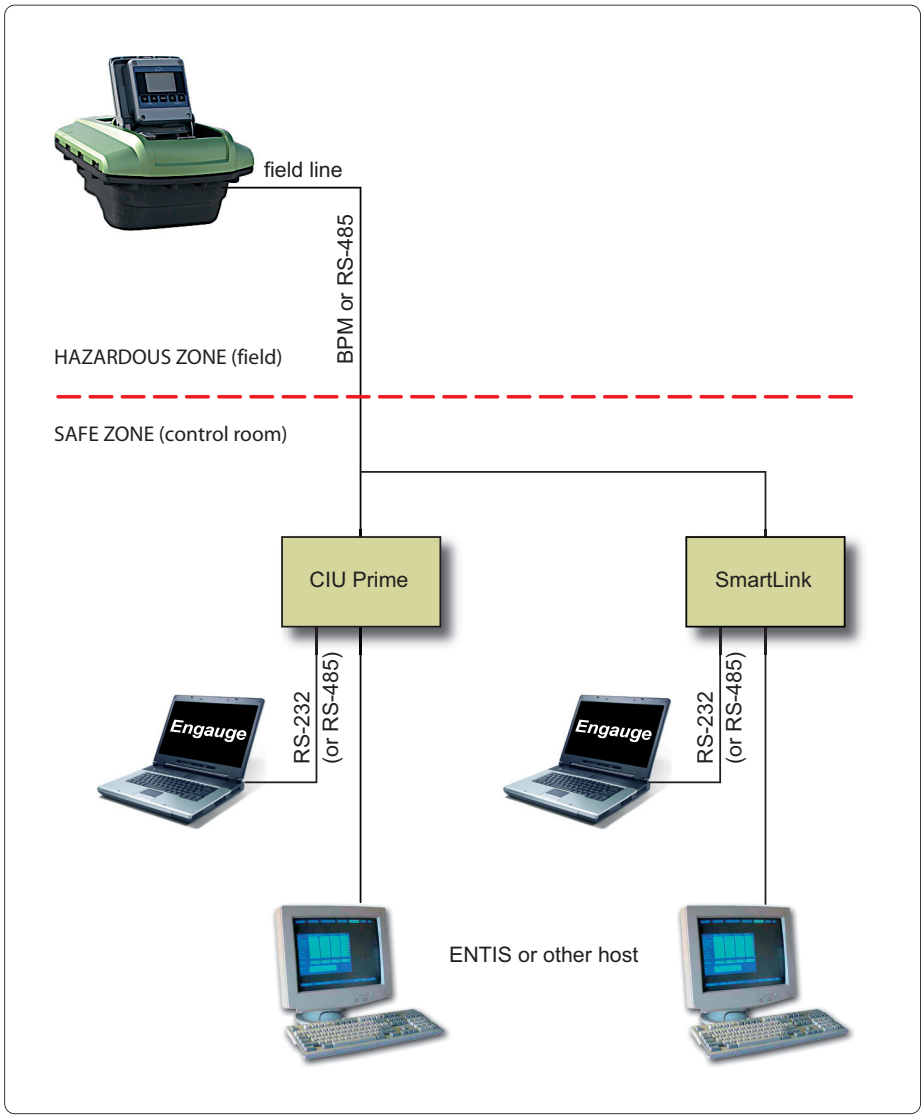
## 4.2 Engauge

### 4.2.1 Connecting the Engauge Service Tool

The *Engauge* service tool is a computer application in which all FlexConn module settings can be performed.

#### 4.2.1.1 Wired Connections Situation (FIGURE 2-17)

Connecting the serial COM-port of a computer or a laptop through an RS-232 (or RS-485) transmission line to either a Communication Interface Unit (CIU) or a SmartLink, enables the control of a SmartRadar FlexLine system.




ESF07-0041

FIGURE 2-17 Connecting the *Engauge* service tool - wired connections

#### 4.2.1.2 OneWireless Situation (FIGURE 2-18)

Connecting the serial COM-port of a computer or a laptop through an RS-232 (or RS-485) transmission line and a Lantronix server, or directly through an Ethernet connection (*Engauge* version 2.4 and later), to a OneWireless gateway enables the control of a OneWireless SmartRadar FlexLine system.

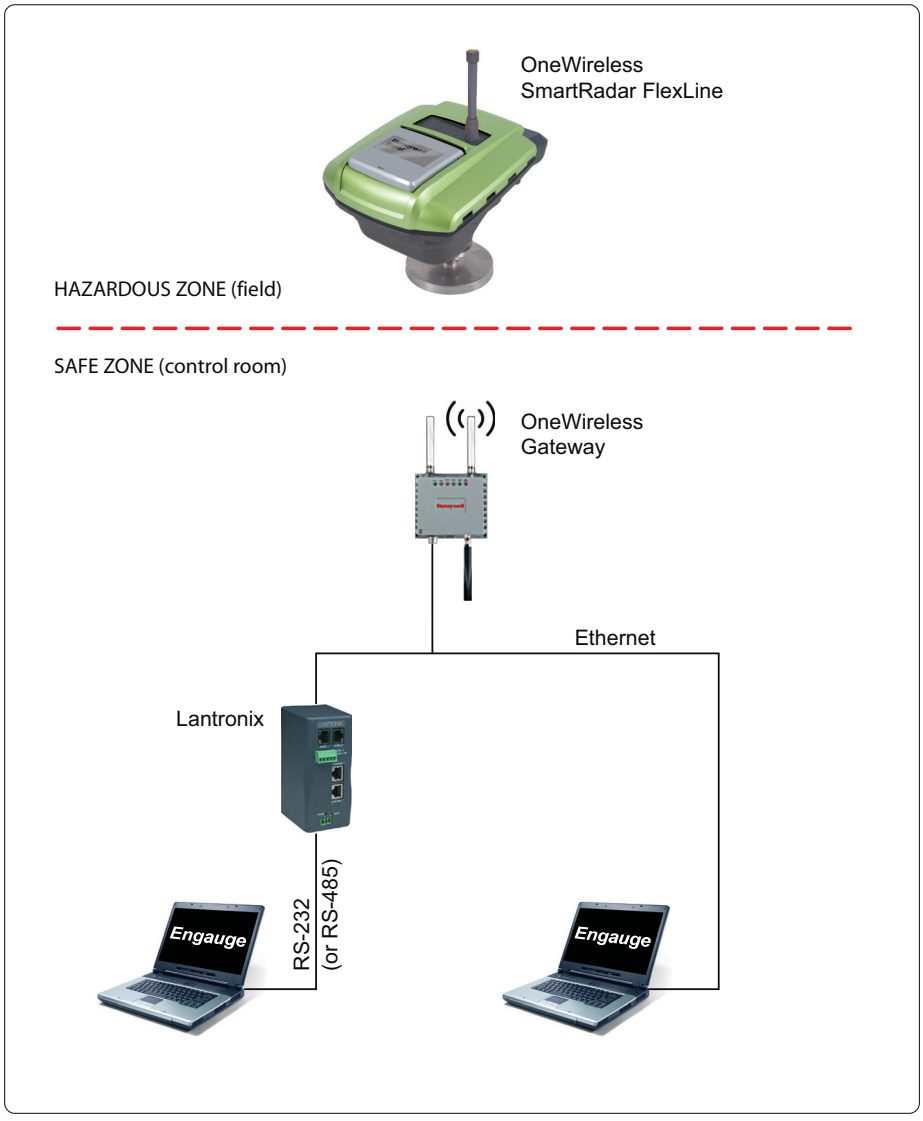



FIGURE 2-18 Connecting the Engauge service tool - OneWireless ESF09-0010

### 4.2.2 Using Engauge

After starting the *Engauge* application, first the specific transmission address of the concerned SmartRadar FlexLine system must be set correctly. Also, the transmission speed (baudrate) must be set.

After this is performed, *Engauge's* explorer appears, and each FlexConn module of the concerned SmartRadar FlexLine system is visible on the left panel. See FIGURE 2-19.

Double-click on the module's icon on the left panel to edit the each individual SmartRadar FlexLine module. The "board descriptor" is loaded and a screen with "tab" pages appears.

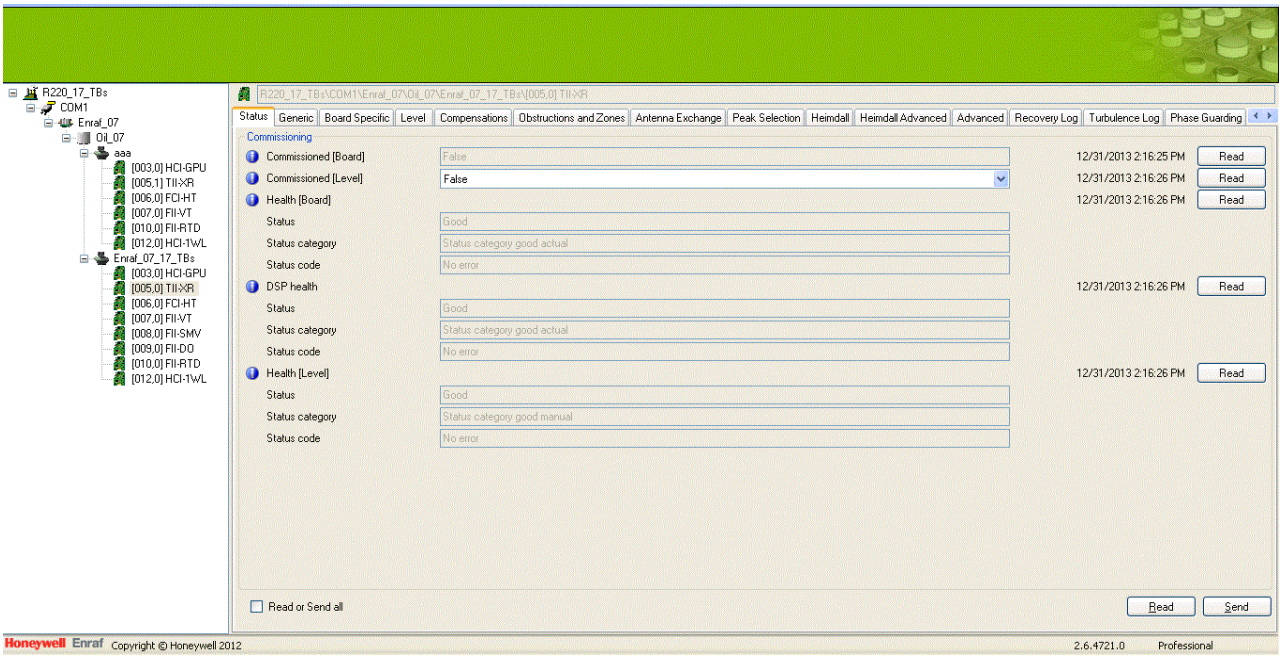



FIGURE 2-19 Example (1) of an *Engauge* screen

ESF09-0001

Browse through the tab pages to reveal the same information/ parameter settings which can be found using the *SmartView*, but in a more user friendly way.

However, some settings or commands can only be executed by *Engauge*. For example, executing an Alarm simulation test is only available through *Engauge*.

### 4.2.3 Some Engauge Screen Examples

Following are some of the *Engauge* screen samples.

After configuring a communication protocol(UDP/COM), running a OneWireless Site scan will list all devices connected to the OneWireless network. This list is displayed in the left panel.

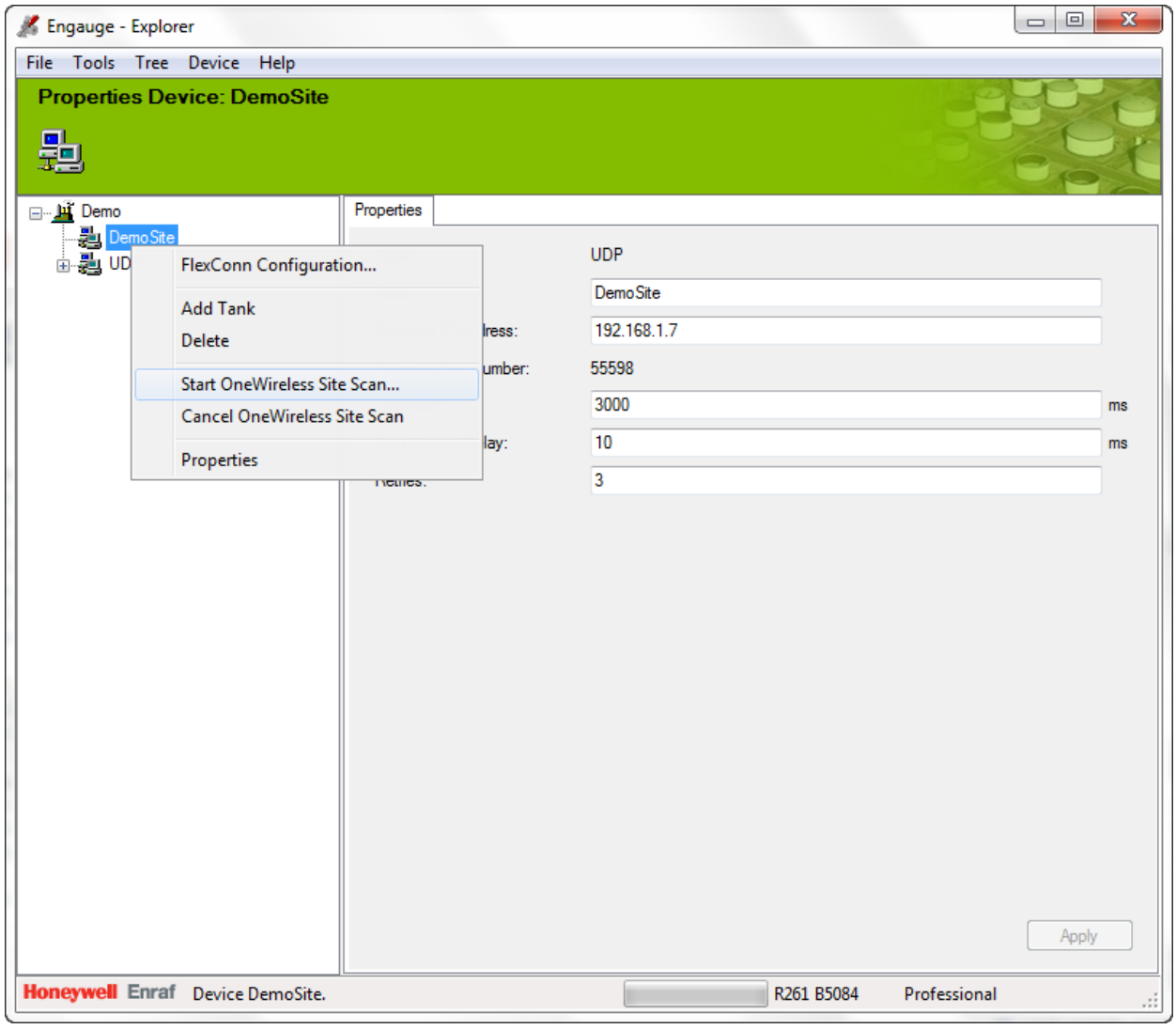
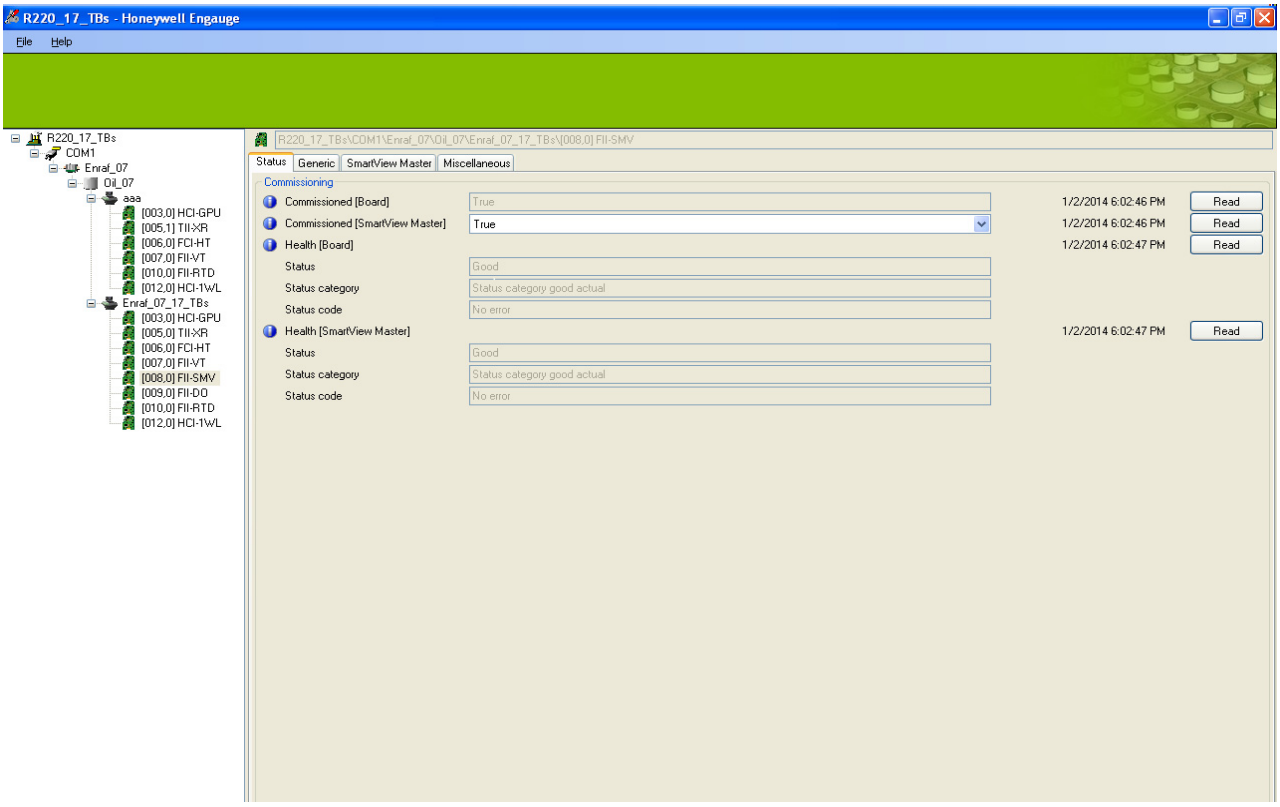



FIGURE 2-20 Example (2) OneWireless Site Scan

ESF09-0002




ESF09-0003

FIGURE 2-21 Example (3) of an *Engauge* screen

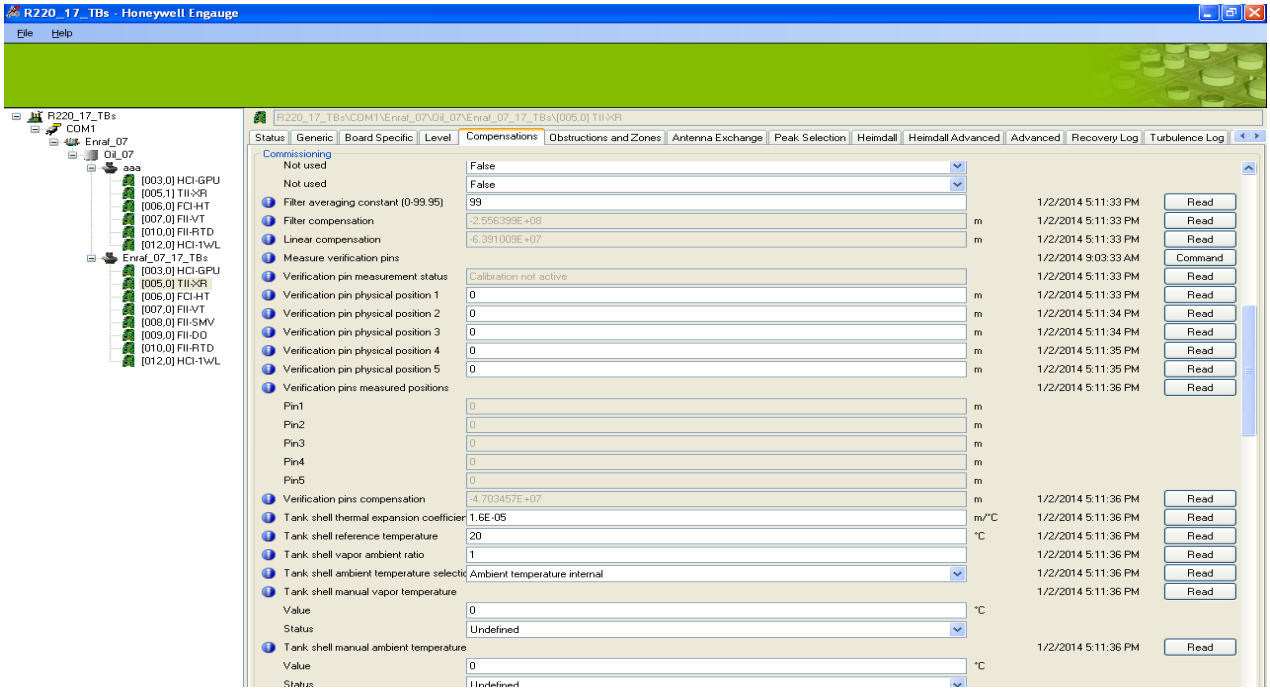



FIGURE 2-22 Example (4) of an *Engauge* screen

ESF09-0004

## 4.3 Configuring OneWireless infrastructure

### 4.3.1 Configuring WDM using the First Time Configuration Wizard

After installing the WDM, you need to configure the WDM to enable it to function in the OneWireless Network. The **First Time Configuration Wizard** guides you through the initial configuration of the WDM. The **First Time Configuration Wizard** appears ONLY when you log on to the OneWireless user interface for the first time or after the WDM is deleted (returning to factory defaults).

#### Considerations

The following are some of the network configuration rules that you must follow while configuring the network properties.

- FDN and PCN must be on separate subnets.
- FDN IP address must be outside the FDAP IP address range.
- FDN subnet mask must include FDN IP address and FDAP IP address range.
- Default PCN gateway must be on the same subnet as PCN.

*WARNING! If you are performing a migration, skip this section and proceed with the tasks available in the OneWireless Migration User's Guide.*

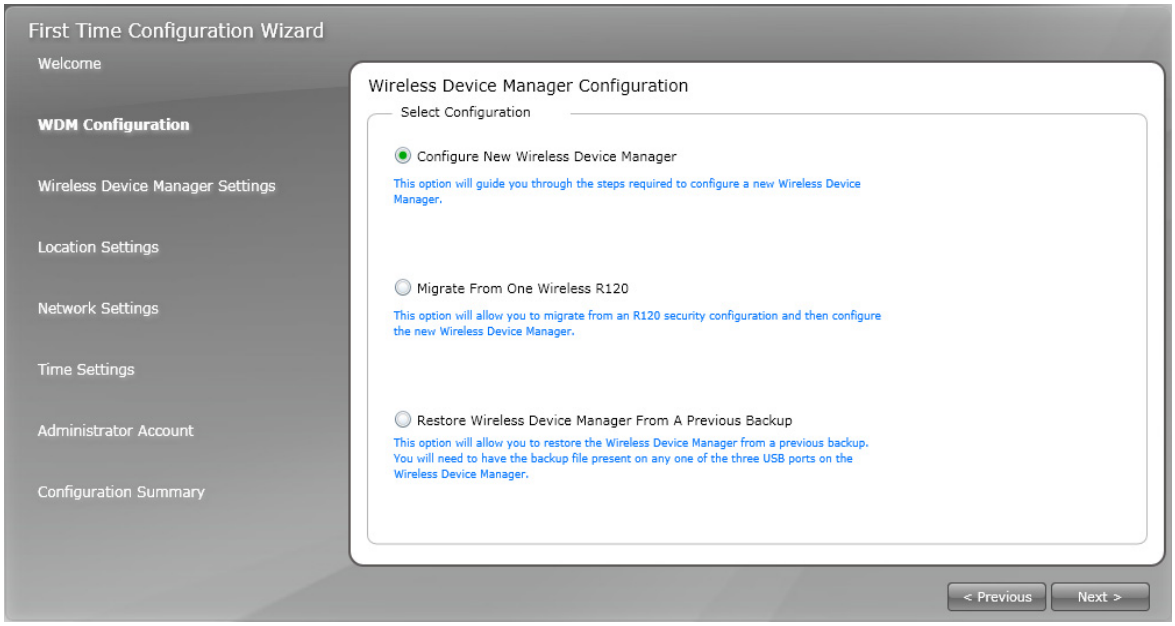
To configure WDM using the First Time Configuration Wizard

1. Log on to the OneWireless user interface using the default **User ID** and **Password**.

   The **First Time Configuration Wizard** appears.

2. On the **Welcome** page of the **First Time Configuration Wizard**, click **Next**.

3. On the **Wireless Device Manager Configuration** page, click **Configure New Wireless Device Manager** and click **Next**.

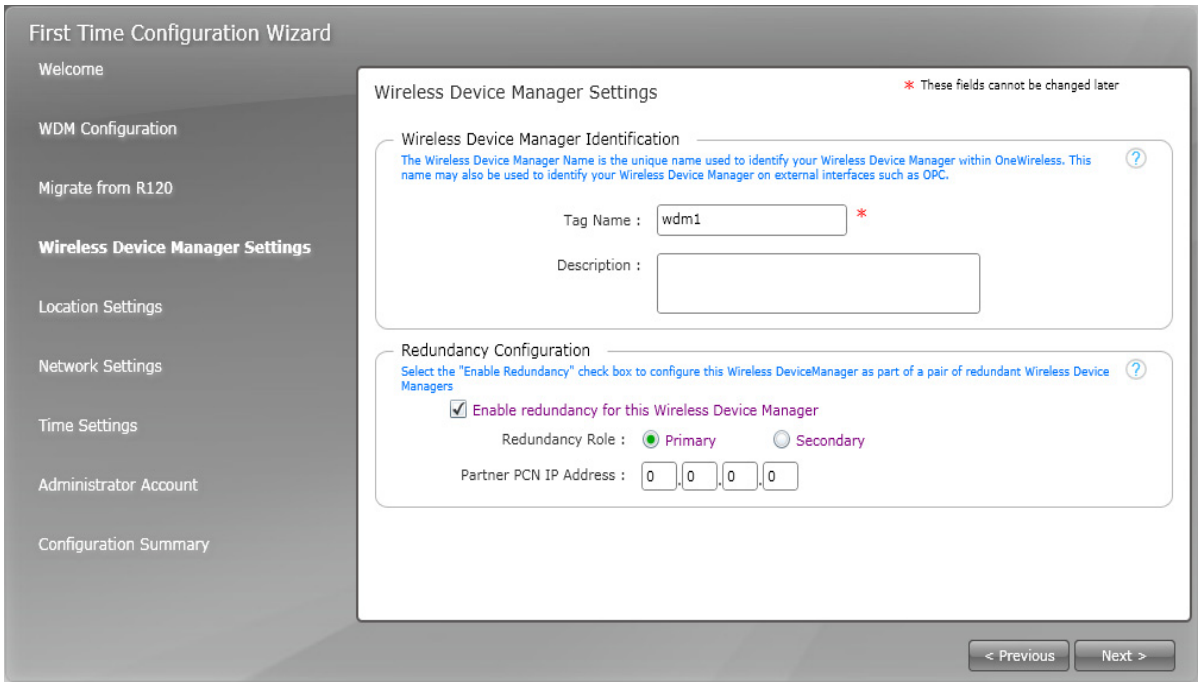

First Time Configuration Wizard
Welcome
WDM Configuration
Wireless Device Manager Settings
Location Settings
Network Settings
Time Settings
Administrator Account
Configuration Summary
Wireless Device Manager Configuration
Select Configuration
Configure New Wireless Device Manager
This option will guide you through the steps required to configure a new Wireless Device Manager.
Migrate From One Wireless R120
This option will allow you to migrate from an R120 security configuration and then configure the new Wireless Device Manager.
Restore Wireless Device Manager From A Previous Backup
This option will allow you to restore the Wireless Device Manager from a previous backup. You will need to have the backup file present on any one of the three USB ports on the Wireless Device Manager.
< Previous
Next >

4. On the **Wireless Device Manager Settings** page, type the WDM **Tag Name** and the **Description**.

   The **Tag Name** is the unique name that is used to identify the WDM. It can be up to 16 characters long and must begin with an alphabetic character.

Do not use special characters in the Tag Name; underscore is the only acceptable character. After completing the initial configuration, you cannot change the WDM name.

The **Description** can be up to 255 characters long.


First Time Configuration Wizard
Welcome
WDM Configuration
Migrate from R120
Wireless Device Manager Settings
Location Settings
Network Settings
Time Settings
Administrator Account
Configuration Summary
Wireless Device Manager Settings
* These fields cannot be changed later
Wireless Device Manager Identification
The Wireless Device Manager Name is the unique name used to identify your Wireless Device Manager within OneWireless. This name may also be used to identify your Wireless Device Manager on external interfaces such as OPC.
Tag Name :
wdm1
Description :
Redundancy Configuration
Select the "Enable Redundancy" check box to configure this Wireless DeviceManager as part of a pair of redundant Wireless Device Managers
Enable redundancy for this Wireless Device Manager
Redundancy Role :
Primary
Secondary
Partner PCN IP Address :
0 . 0 . 0 . 0
< Previous
Next >

5. If you need to configure redundant WDM, then under **Redundancy Configuration**, configure the following:
   a) Select **Enable redundancy for this Wireless Device Manager** check box.
   b) Click the **Redundancy Role**, as required. You can select either **Primary** or **Secondary** option depending on the redundancy role.
   c) In the **Partner PCN IP Address** box, type the IP address of the partner WDM.

*NOTE: When redundancy is enabled, the primary WDM is assigned physical ID A and the secondary WDM is assigned physical ID B. The physical IDs are displayed in the UI during normal operation. Tagging the physical hardware with matching labels makes it easy to distinguish the WDMs later.*

6. Click **Next**.

   The **Location Settings** page appears.

*WARNING! If you have selected the **Redundancy Role** as **Secondary** in the **Wireless Device Manager Settings** page, then the **Location Settings** page options are disabled.*

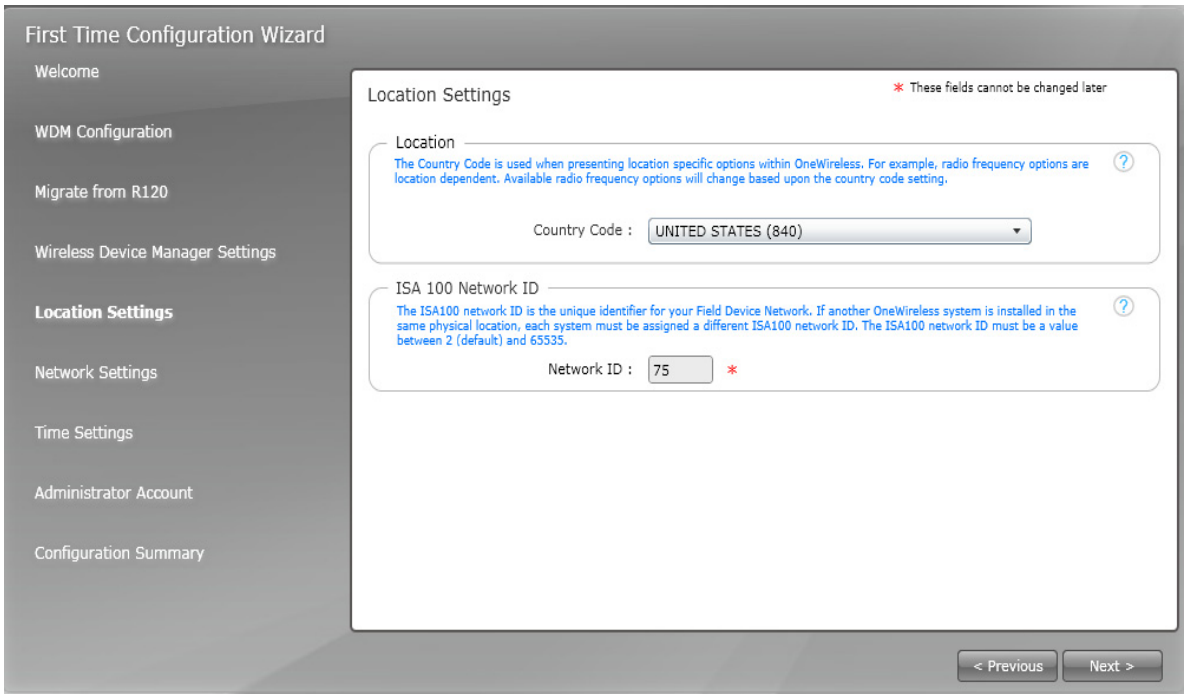
7. Under **Location**, select the **Country Code**.

   The country code is used to define any location-specific settings within the OneWireless Network. For example, radio frequency options are location

dependent and vary depending on the country code setting. After completing the first time configuration, you cannot modify the **Country Code**.

8. Under **ISA 100 Network ID**, type the **Network ID**.

   The ISA100 Network ID is the unique identifier for the network. It must contain a value between 2 (default) and 65535. After completing the first time configuration, you cannot change the **Network ID**.


First Time Configuration Wizard
Welcome
WDM Configuration
Migrate from R120
Wireless Device Manager Settings
Location Settings
Network Settings
Time Settings
Administrator Account
Configuration Summary
Location Settings
* These fields cannot be changed later
Location
The Country Code is used when presenting location specific options within OneWireless. For example, radio frequency options are location dependent. Available radio frequency options will change based upon the country code setting.
Country Code :
UNITED STATES (840)
ISA 100 Network ID
The ISA100 network ID is the unique identifier for your Field Device Network. If another OneWireless system is installed in the same physical location, each system must be assigned a different ISA100 network ID. The ISA100 network ID must be a value between 2 (default) and 65535.
Network ID :
75
*
< Previous
Next >

9. Click **Next**.

   The **Network Settings** page appears.

10. Under **Field Device Network (FDN)**, configure the network settings for the wireless field device network as follows.

    a) **Field Device Network IP Address**: These settings are used to configure the wireless field device network Ethernet connection for the WDM. This is used for communication with FDAP.

*WARNING! After completing the initial configuration, you cannot change the **Field Device Network IP Address** specified in the **First Time Configuration Wizard**.*

    b) **Subnet Mask**: A subnet mask identifies the bits of an IP address that are reserved for the network address. For example, if the IP address of a particular node is 192.168.2.3 with a subnet mask of 255.255.255.0, the subnet mask indicates that the first 24 bits of the address represent the network address. The last 8 bits can be used for individual node addresses on that network.

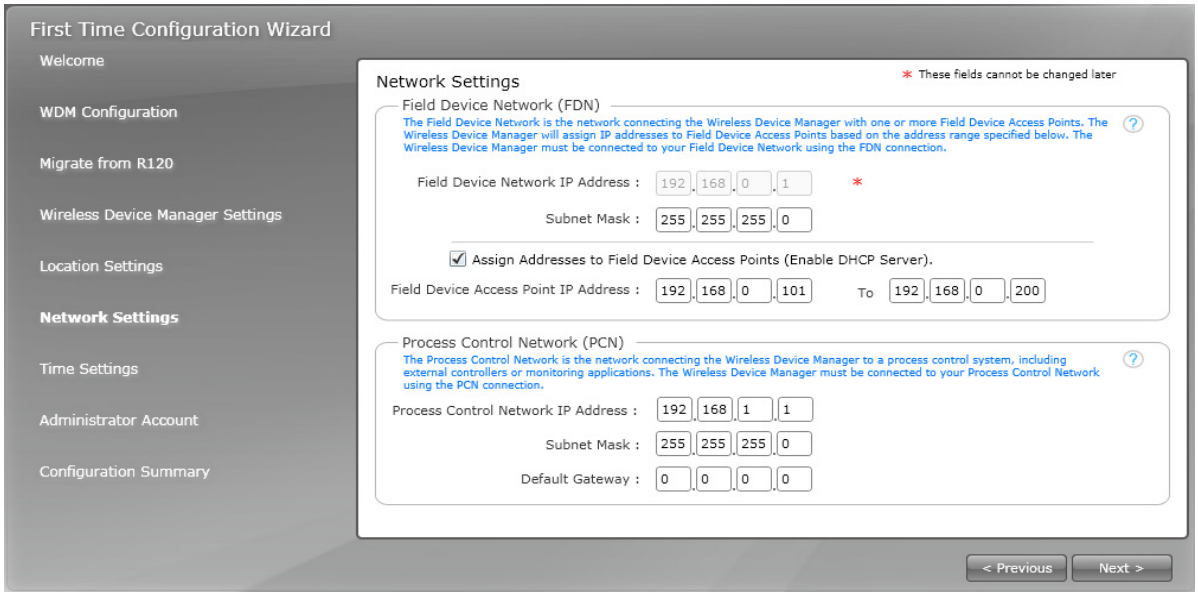
    c) **Assign Addresses to Field Device Access Points (Enable DHCP Server)**: Select this check box to enable the WDM to act as the DHCP Server. Ensure you do not select the check box if

the network has another DHCP Server. It is recommended to enable the WDM to act as the DHCP Server.

d) **Field Device Access Point IP Address**: This option is enabled only if you have selected the **Enable DHCP Server** check box. Accept the default range or configure the IP address range according to the network settings in the plant network. The WDM that acts as the DHCP Server assigns IP addresses based on the range specified. Ensure that the IP addresses of the Access Points are not within the DHCP address range.

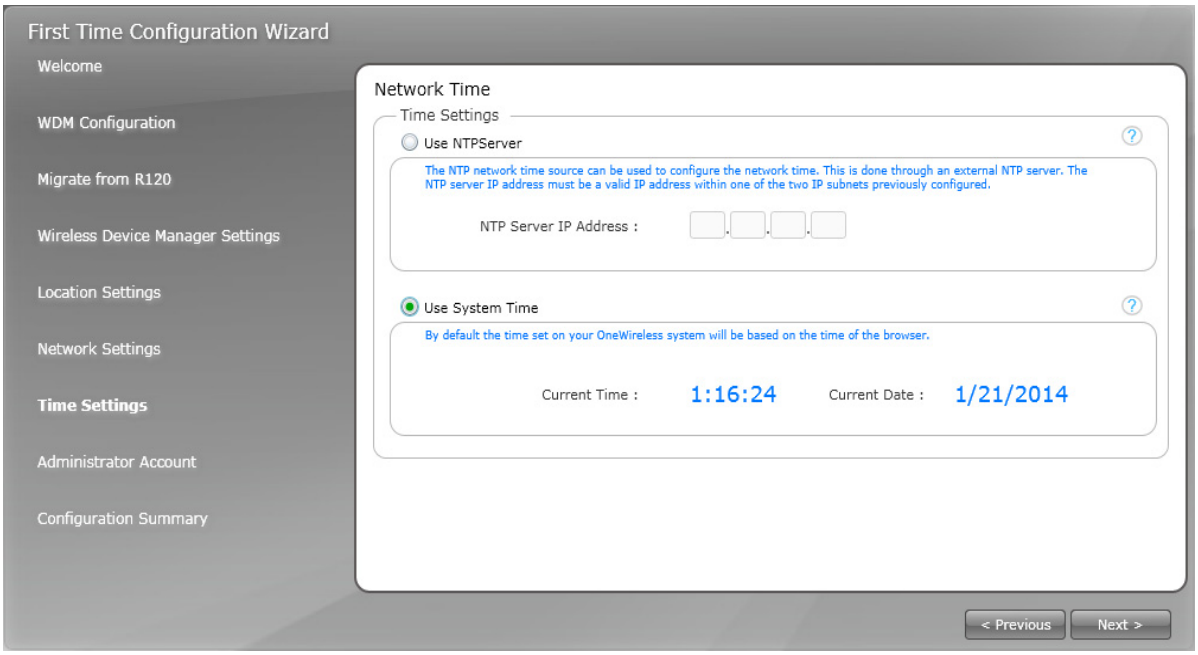
If you do not enable DHCP Server during the first time configuration, it is possible to enable this at a later stage using the Property Panel.

*WARNING! DHCP server configuration option is disabled on a secondary WDM.*


First Time Configuration Wizard
Welcome
WDM Configuration
Migrate from R120
Wireless Device Manager Settings
Location Settings
Network Settings
Time Settings
Administrator Account
Configuration Summary
Network Settings
* These fields cannot be changed later
Field Device Network (FDN)
The Field Device Network is the network connecting the Wireless Device Manager with one or more Field Device Access Points. The Wireless Device Manager will assign IP addresses to Field Device Access Points based on the address range specified below. The Wireless Device Manager must be connected to your Field Device Network using the FDN connection.
Field Device Network IP Address : 192 168 0 1 *
Subnet Mask : 255 255 255 0
Assign Addresses to Field Device Access Points (Enable DHCP Server).
Field Device Access Point IP Address : 192 168 0 101 To 192 168 0 200
Process Control Network (PCN)
The Process Control Network is the network connecting the Wireless Device Manager to a process control system, including external controllers or monitoring applications. The Wireless Device Manager must be connected to your Process Control Network using the PCN connection.
Process Control Network IP Address : 192 168 1 1
Subnet Mask : 255 255 255 0
Default Gateway : 0 0 0 0
< Previous
Next >

11. Under **Process Control Network (PCN)**, configure the process control network settings as follows.
    - **Process Control Network IP Address**: The process control network settings are used to configure the process control network Ethernet connections for the WDM. This is used for communication with monitoring applications and external controllers.
    - **Subnet Mask**
    - **Default gateway**: Used to access the subnets outside the PCN subnet. This is an optional configuration option.
12. Click **Next**.

The **Network Time** page appears.


First Time Configuration Wizard
Welcome
WDM Configuration
Migrate from R120
Wireless Device Manager Settings
Location Settings
Network Settings
Time Settings
Administrator Account
Configuration Summary
Network Time
Time Settings
Use NTPServer
The NTP network time source can be used to configure the network time. This is done through an external NTP server. The NTP server IP address must be a valid IP address within one of the two IP subnets previously configured.
NTP Server IP Address :
Use System Time
By default the time set on your OneWireless system will be based on the time of the browser.
Current Time : 1:16:24
Current Date : 1/21/2014
< Previous
Next >

*WARNING! The network time settings configuration is disabled on the secondary WDM. Upon synchronization, the secondary WDM syncs time from primary over the FDN interface.*

13. Click **Use NTPServer** or **Use System Time**, as required.

    You can use either the NTP server or system time to configure the network time of the OneWireless Network.

*NOTE: By default, the network time is configured as the system time. Consider the following while configuring an external NTP server.*

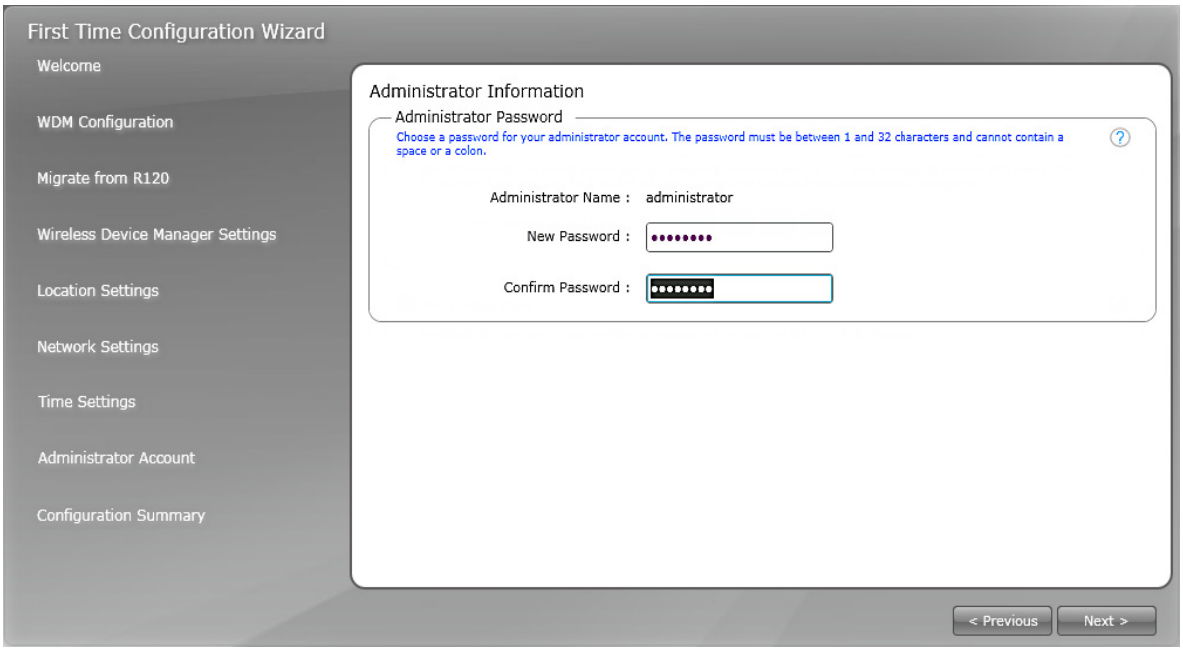
- NTP server should be on the PCN or FDN.
- NTP server IP address must be within FDN or PCN subnet unless a default gateway has been configured on the PCN subnet and the NTP server is accessible through the default gateway.
- NTP server IP address should not overlap with the FDN and PCN IP addresses.
- NTP server IP address should not overlap with FDAP IP address range, if DHCP Server is enabled.

14. If you are selecting NTP server, enter the **NTP Server IP Address** and click **Next**.

    The **Administrator Information** page appears.

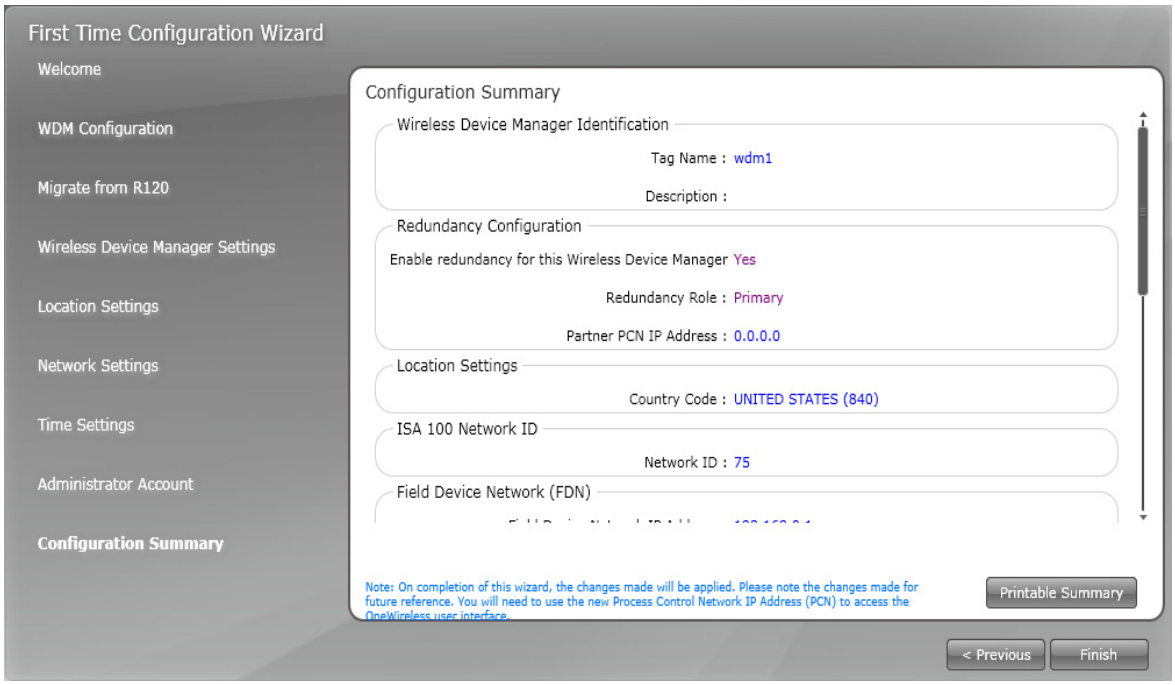
15. Type the user name and password in the **Administrator Name, New Password**, and **Confirm Password** fields.
    - The default user name configured for the WDM is **administrator**. You can change the default user name in the **First Time Configuration Wizard**, if required. However, you cannot change the user name after completing the initial configuration.

- The password must contain at least one character and can contain up to 32 characters. It should not start or end with a space and must not contain single quote (‘).




16. Click **Next**.

    The **Configuration Summary** page appears which displays the summary of all the configuration information specified in the **First Time Configuration Wizard**. An incorrect entry is indicated by a warning icon. Hovering the mouse over the icon displays a tooltip with the information about the incorrect entry.


First Time Configuration Wizard
Welcome
WDM Configuration
Migrate from R120
Wireless Device Manager Settings
Location Settings
Network Settings
Time Settings
Administrator Account
Configuration Summary
Configuration Summary
Wireless Device Manager Identification
Tag Name : wdm1
Description :
Redundancy Configuration
Enable redundancy for this Wireless Device Manager Yes
Redundancy Role : Primary
Partner PCN IP Address : 0.0.0.0
Location Settings
Country Code : UNITED STATES (840)
ISA 100 Network ID
Network ID : 75
Field Device Network (FDN)
Note: On completion of this wizard, the changes made will be applied. Please note the changes made for future reference. You will need to use the new Process Control Network IP Address (PCN) to access the OneWireless user interface.
Printable Summary
< Previous
Finish

17. Verify the WDM settings, correct errors if any, and then click **Finish**.

    If there are any errors in the configuration information that you have provided, then the system does not allow you to click **Finish**.

18. On the **Browser Redirect** dialog box, click **OK**.

    The wizard redirects the Web browser to the revised process control network IP address.

*WARNING! If you are configuring the WDM to use the same process control network IP address, then the wizard redirects the Web browser.*

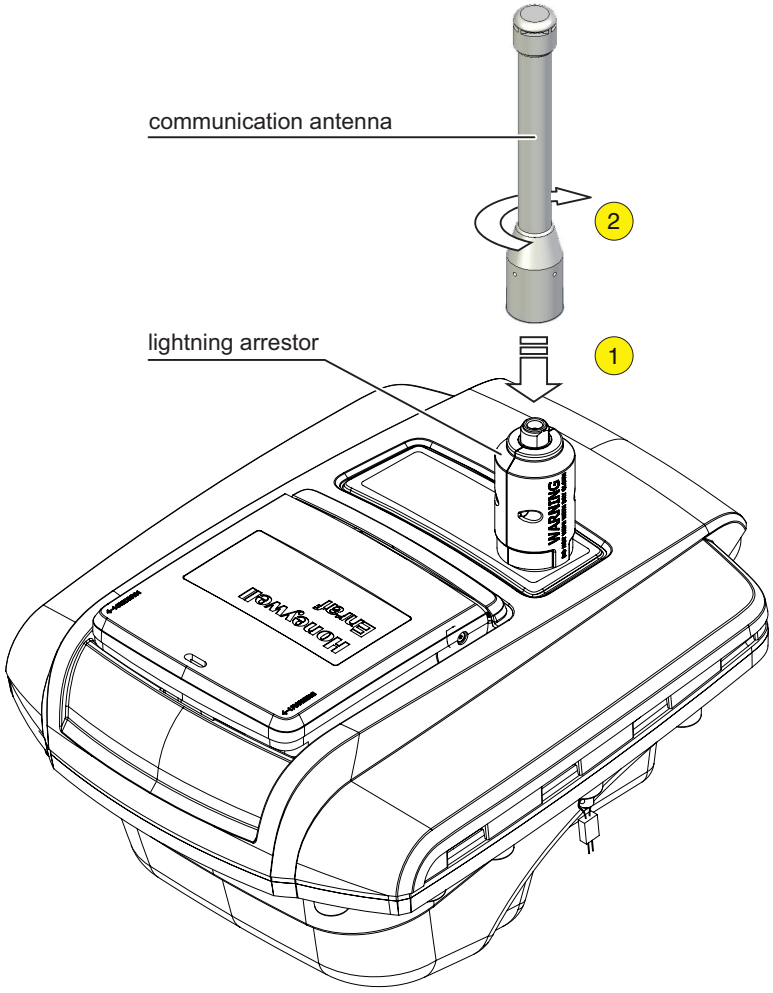
*If you have configured the WDM using a different PCN IP subnet than the computer, then you need to reconfigure the network settings of the computer to access the user interface using the IP address on the new subnet.*

# CHAPTER 5 INSTALLATION

Attention!

- Before starting with commissioning activities, first **make sure all mechanical and electrical installation aspects have been completed correctly**.
- For installation, see the *Installation Guide* for the SmartRadar FlexLine.
- In case the **OneWireless Communication Option (HCI-1WL)** is installed, a **lightning arrestor** is integrated by default. The lightning arrestor (see figure below) prevents the inside electronics from being affected in case of a nearby lightning strike. Although it protects against multiple discharges, it can be replaced as a preventive maintenance action. Preventive maintenance interval depends on location, position of the equipment, grounding, and other protection measures installed.

*NOTE: Contact our service department for any guidance if needed, through e-mail: enraf.helpdesk@honeywell.com*



# CHAPTER 6 CONFIGURING THE ONEWIRELESS NETWORK COMPONENTS FOR R220

## 6.1 Provisioning the OneWireless Network components

### 6.1.1 Provision the WDM using over-the-air provisioning method

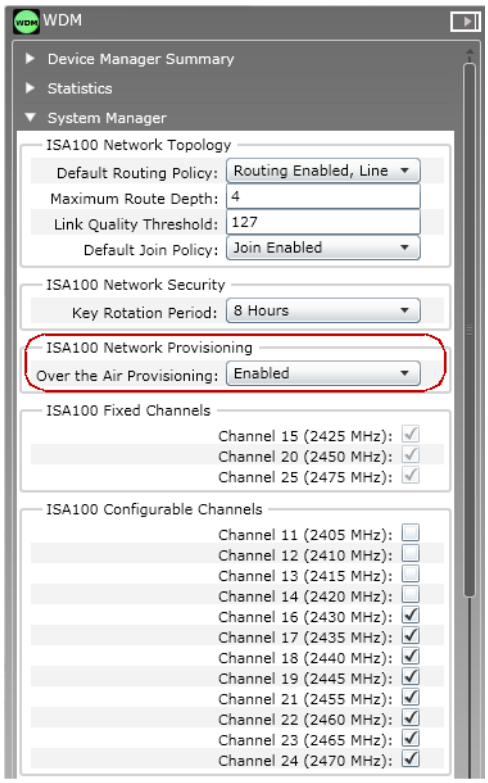
Devices in the OneWireless Network can be provisioned using over-the-air provisioning method. WDM provisions the access points and the access points that are enabled to function as provisioning devices can provision the field devices. To enable over-the-air provisioning capability, you must enable this feature in the user interface.

Any access point that is in the factory default state, when connected to the OneWireless Network can join the network as an unprovisioned device. In this state, the WDM contains only the basic details about the device such as the Tag Name, EUI64, and Radio Revision. Also, there is no active data communication between the WDM and the device in the unprovisioned state. You can accept or reject an unprovisioned device using the user interface. If accepted, the WDM sends the provisioning data to the device and the device transitions to provisioning state. A device with the new security data sends join request to the WDM.

**To provision the access points using over-the-air provisioning method**

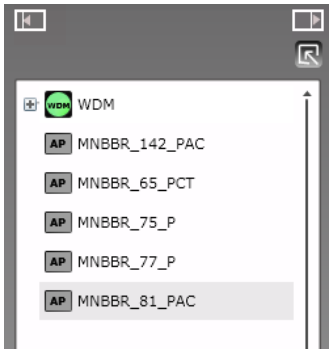
1. On the Selection Panel, select the WDM.
2. On the Property Panel, expand **System Manager**.
3. Under **ISA100 Network Provisioning**, in the **Over the Air Provisioning** group, select **Enabled**.

   The WDM is enabled for over-the-air provisioning support.




4. Click **Apply**.

   The unprovisioned access points start appearing in the Selection Panel. You can filter the device list to view only the unprovisioned access points in the network.

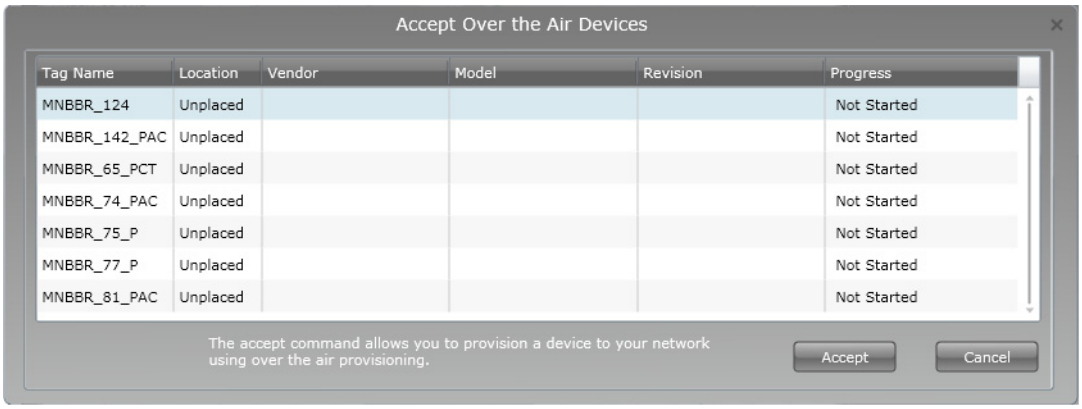



5. On the ribbon bar, in the **Filter** group, click **Device Status** > **Un-Provisioned**.
6. Expand the extended Selection Panel to view the available device parameters.
7. Select the required access point in the Selection Panel or the map view and then click **Accept** on the ribbon bar.

*NOTE: You can select multiple access points using the Selection Panel or the map view. Use SHIFT+click to*

*select multiple items in a successive list. Use CTRL+click to select multiple items not in succession.*
*It is recommended that you select and accept only 10 devices at a time.*

The **Accept Over the Air Devices** dialog box appears. The dialog box displays all the unprovisioned access points that you have selected for enabling over-the-air provisioning.




8. Click **Accept**.

   The **Progress** column displays the status as **In Progress**, **Provisioning**, and then **Completed** when complete. Do not close the dialog box when over-the-air provisioning is initiated for devices.

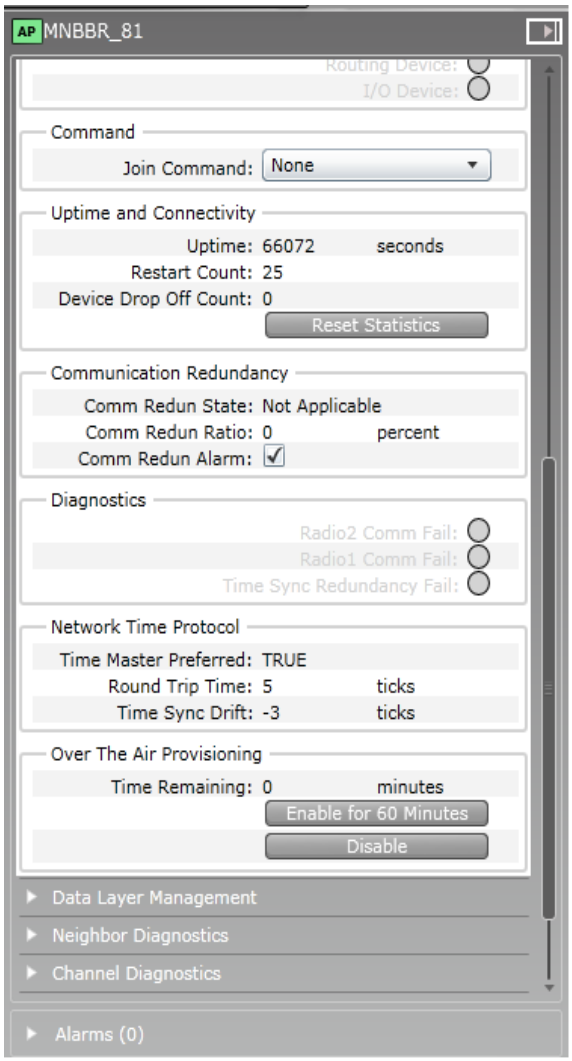
9. Click **Close**.

   The **Accept Over the Air Devices** dialog box closes.

*NOTE: R220 SmartRadar FlexLine field devices can be provisioned using the over-the-air provisioning method and also by using an SD card.*

### 6.1.2 Provision SmartRadar FlexLine field devices using over-the-air provisioning method

1. On the Selection Panel, select the access point.
2. On the Property Panel, expand **Device Management**.
3. Under **Over The Air Provisioning**, click **Enable for 60 Minutes**.




The access point functions as a provisioning device for 60 minutes. The unprovisioned SmartRadar FlexLine field devices that are in the factory default state start appearing in the Selection Panel. Note that if you do not accept or reject the devices within 60 minutes, the devices automatically disappear from the user interface.

4. To filter the SmartRadar FlexLine field device list:

   On the ribbon bar, in the **Filter** group, click **Device Status** > **Un-Provisioned**.

   The unprovisioned devices appear in the Selection Panel. The extended Selection Panel enables you to view the available device parameters.

   The device establishes a communication link with the access point after it attains the unprovisioned state. This link persists even if the device is not provisioned using the connected access point. If the

device needs to be provisioned using a different access point, reject the device and then delete it from the user interface, so that the device can rejoin through a different access point for provisioning.

5. Select the required SmartRadar FlexLine field device in the Selection Panel or the map view and then click **Accept** on the ribbon bar.

*NOTE: You can select multiple access points using the Selection Panel or the map view. Use SHIFT+click to select multiple items in a successive list. Use CTRL+click to select multiple items not in succession.*

*It is recommended that you select and accept only 10 devices at a time.*

The **Accept Over the Air Devices** dialog box appears.

The dialog box displays all the unprovisioned devices that you have selected for enabling over-the-air provisioning.

*NOTE: To reject a device from joining the network using over-the-air provisioning method.*

*Select the required device and click **Reject** in the ribbon bar.*
*The **Reject Over the Air Devices** dialog box displays.*

*Click **Reject**.*
*The **Progress** column displays the status as **In Progress**, and then **Completed**, when complete.*

*Click **Close**.*
*The **Reject Over the Air Devices** dialog box closes.*

6. Click **Accept**.

   The **Progress** column displays the status as **In Progress**, **Provisioning**, and then **Completed**, when complete. Do not close the dialog box when over-the-air provisioning is initiated for devices.

7. Click **Close**.

   The **Accept Over the Air Devices** dialog box closes.

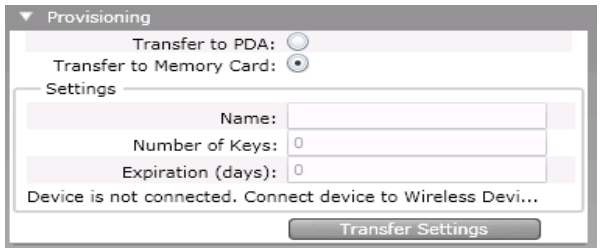
   All the field devices that you have selected for over-the-air provisioning are provisioned.

*NOTE: By default, the selected SmartRadar FlexLine field devices are provisioned and joined as line powered routers.*
*Select **Device Management** > **Routing Assignment** > **Routing Disabled** to disable the routing field devices to function as line powered routers.*

### 6.1.3 Provision SmartRadar FlexLine field devices using SD card

**To provision a SmartRadar FlexLine field device using a SD card**

1. Connect an SD card to a computer or a laptop and format the card with the default windows settings.
2. Generate a security key using the OneWireless Device Manager and transfer the key to the SD card.




3. Power OFF the SmartRadar FlexLine device and open the enclosure.
4. Insert the SD card in the SD card slot provided on the HCI-1WL board.
5. Close the SmartRadar FlexLine device and power it ON.

   ISA100 key is provisioned automatically.

### 6.1.4 Removing the provisioning key from SmartRadar FlexLine gauge

To enable the SmartRadar FlexLine gauge to join another network, you must remove the security configuration on the device and then reprovision the device using over-the-air provisioning.

**To remove the provisioning key from SmartRadar FlexLine gauge**

1. On SmartView, press the UP ARROW and DOWN ARROW simultaneously (**MENU** push buttons) to view the menu items on the display.
2. On the display, scroll to the **commands** item using the MENU buttons.
3. Press the LEFT ARROW and RIGHT ARROW (**SELECT** push buttons) simultaneously.

   You are prompted to enter the password. The default password for SmartView is AAAAAA.

4. Use the MENU push buttons to enter the password and then press the **SELECT** push buttons.

   The list of commands appears.

5. Scroll to select the CAN-1WL FlexConn board name and then press the **SELECT** push buttons.
6. Scroll to select **board** and then press the **SELECT** push buttons.
7. Scroll to select **Restore Default** then press the **SELECT** push buttons.

The provisioning key on the SmartRadar FlexLine gauge is now removed.

### 6.1.5 Resetting the provisioning key from SmartRadar Flexline gauge using a SD card

**To reset the provisioning key from a SmartRadar Flexline gauge using a SD card**

1. Connect an SD card to a computer or a Laptop and format the card with default windows settings.
2. Generate a reset key using the OneWireless Device Manager and transfer the key to the SD card.
3. Power OFF the SmartRadar FlexLine device and open the enclosure.
4. Insert the SD card in the SD card slot provided on the HCI-1WL board.
5. Close the SmartRadar FlexLine device and power it on.

The provisioning key on the SmartRadar FlexLine is automatically reset and the device enters the factor default mode.

## 6.2 Configuring SmartRadar FlexLine field device

### 6.2.1 Loading the Device Description file

A Device Description (DD) file is usually a zip file that is available on the disk supplied in the Honeywell Process Solutions website. It contains information about the device type, commands that are supported by the device, and other device-specific data. A DD file for a particular field device is used to describe the device and to interpret messages and the device status.

*NOTE: To ensure consistency in the channel names, load the DD files before the device joins the network.*

**To load the Device Description file**

1. On the ribbon bar, in the **Maintenance** group, click **Templates**.

   The **Load DD File** dialog box appears.
2. Click **Load DD File**.
3. Browse to the directory location of the DD file.
4. Select the DD file and click **Open**.

   The DD file is uploaded to the WDM and an upload success message appears.
5. Click **Close** to close the **Load DD File** dialog box.
6. Repeat steps to load the DD files for all the device types.

### 6.2.2 Configuring routing assignment

After joining the network for the first time, a field device capable of operating as a router and an I/O device initializes its routing assignment based on the current default routing policy. It is possible to override the default routing policy by configuring routing assignment for field devices. Configuring device routing assignment results in restarting the device with a new role.

#### 6.2.2.1 Considerations

- Device routing assignment can be configured only for devices that are capable of operating as routers and I/O devices.

**To configure routing assignment**

1. On the Selection Panel, select the field device.
2. On the Property Panel, expand **Device Management**.
3. Select **Routing Assignment**, as appropriate.

   The following are the **Routing Assignment** options available.

   - **Routing Disabled** — Disables the ability of a routing field device to function as a router. The field device can function only as an I/O device.
   - **Routing Enabled** — Enables the routing field device to function as a router and an I/O device. The default join policy configured is **Follow System Manager Policy**.
   - **Not Applicable**
     - Does not apply to devices that are capable of operating as access points.
     - Does not apply to devices that are only capable of operating as routers.
4. Select one of the following **Join Assignment** options, as required.

   The **Join Assignment** overrides the system manager join policy. This is applicable only for routing field devices.

   - **Join Disabled** — Disables device-join through this device.
   - **Join Enabled** — Enables device-join through this device.
   - **Follow System Manager Policy** — Enables the device to follow the system manager join policy. Device-join through this device depends on the configured system manager join policy.

   The **Join Status** is a read-only parameter that indicates the resultant join state for all the devices.

   - Access Points, FDAP access points, and FDAP routers have the **Join Assignment** permanently set to J**oin Enabled**.
   - Non-routing field devices have the **Join Assignment** permanently set to **Join Disabled**.

- Routing field devices have the default **Join Assignment** set to **Follow System Manager Policy**.

By default, the selected SmartRadar FlexLine field devices are provisioned and joined as line powered routers. Select **Device Management** > **Routing Assignment** > **Routing Disabled** to disable the routing field devices to function as line powered routers.

5. Click **Apply**.

### 6.2.3 Configure tag name and description

**To configure tag name and description**

1. On the Selection Panel, select the field device.
2. On the Property Panel, expand **Field Device Summary**.
3. Type the required **Tag Name**.

*NOTE: You can change the Tag Name by double-clicking the field device name in the Selection Panel.*

4. Type the required **Description**.
5. Click **Apply**.

### 6.2.4 Configure publication rate

The publication data for input and output field devices can be configured using the Input Publication panel in the Property Panel. Depending on the device type, a field device can have an Input Publication panel. This is determined by the DD file for the field device.

The Input Publication panel contains the following configuration options.

- **Contract Status** — A contract is a communication resource (bandwidth) allocation between two devices on the ISA100 network. The following are the status values that are displayed depending on the status of the contract.
  - **Not Configured** - No contract established due to incorrect configuration of the device.
  - **Activating** - Contract establishment is in progress.
  - **Active**- Contract is active.
  - **Active, Negotiated Down** - If a device requests a contract for periodic publications at a fast rate (such as 1 second) and if the communication resources are not available, the contract is negotiated down to a slower publication period (such as 5 seconds).
  - **Terminating** - Contract termination is in progress.
  - **Failed** - Contract establishment is failed.
  - **Inactive** - Contract is inactive.
- **Rate** – The rate at which a field device publishes data.

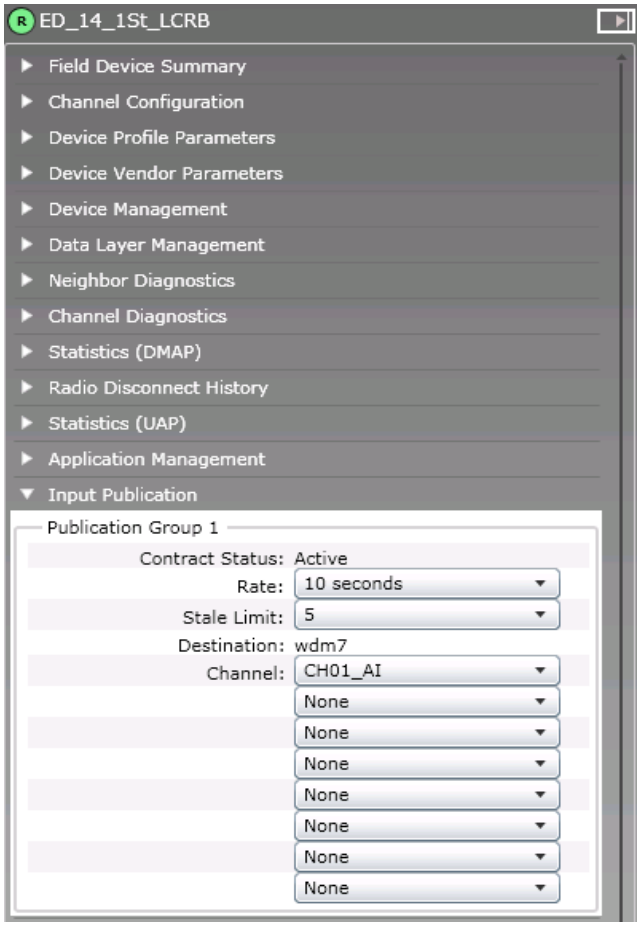
*NOTE: Honeywell recommends that you set the **Rate** as 10 seconds.*

- **Stale Limit** – Defines the maximum number of stale input values that can be received before the input status is set to Bad. It is recommended that for 1 second publication period, the stale limit should be set to 15 seconds. For all other publication periods (5 seconds, 10 seconds, 30 seconds, and 1 minute), the stale limit should be set to 5.
- **Destination** – Destination of publication for output devices .
- **Channel** – The list of channels for which the publication configuration applies.

*NOTE: When a device joins the network, the WDM automatically configures its publication period as 10 seconds.*

### To configure publication rate and stale limit

1. On the Selection Panel, select the field device.
2. On the Property Panel, expand **Input Publication**.




3. In the **Rate** field, select the publication rate, as appropriate.
4. In the **Stale Limit** field, select the stale limit, as appropriate.
5. Click **Apply**.

## 6.3 Configuring SmartRadar FlexLine field device channels

### 6.3.1 Configure Mode and Scale

**To configure Scale**

1. On the Selection Panel, select the SmartRadar FlexLine field device channel.
2. On the Property Panel, expand **Process Variable** to view the following read-only parameters in the OneWireless user interface.

*NOTE: The configuration of the engineering units should be performed using the Engauge tool only. The parameter values of the sensor cards get reflected in the OneWireless user interface as read-only parameters.*

- **EU at 100%**: Specifies the high range PV value in Engineering Units.
- **EU at 0%**: Specifies the low range PV value in Engineering Units.
- **Units Index**: Specifies the unit of the measurement value. The value varies according to the sensor type selected for a channel. For example, the process value of the TII-XR sensor card is displayed as CH01_AI_1 and the Units Index is set to m.

3. Click **Apply**.

*NOTE: After applying the changes, the newly configured values appear under the **Scale** panel.*

**To configure Mode**

1. On the Property Panel, expand **Mode**.
2. In the **Target** list, select the mode as required.

   The mode types available are Normal, OOS, and Auto.

3. Click **Apply**.

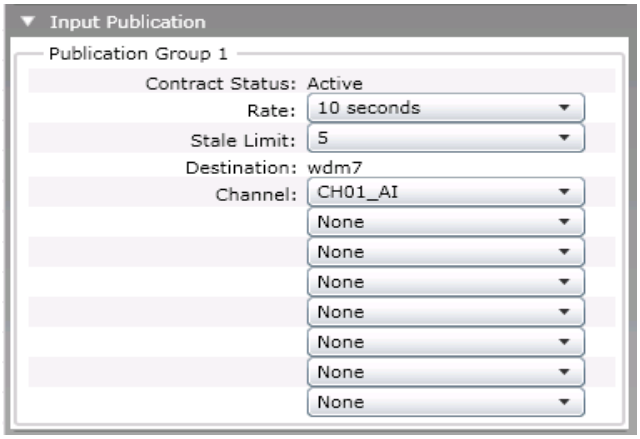
### 6.3.2 Add channels to publication groups

Perform the following steps to enable/disable the PV publication capability of field devices.

**To add channels to publication groups**

1. On the Selection Panel, select the SmartRadar FlexLine field device channel.
2. On the Property Panel, expand **Input Publication** panel.

3. In the **Channel** drop-down list, select the channels for which data publication needs to be enabled.




*NOTE: To disable data publication, select **None** in the **Channel** list.*

4. Click **Apply**.

### 6.3.3 Remove channels from publication groups

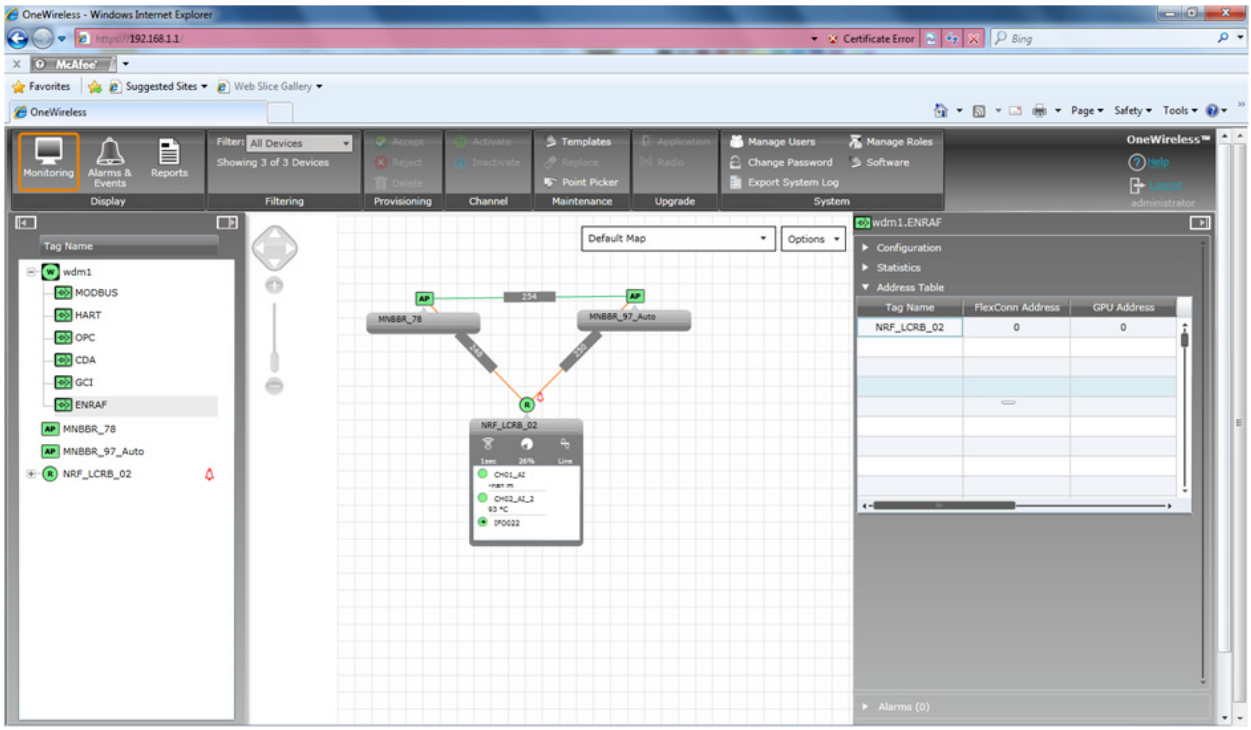
**To remove channels from publication groups**

1. On the Selection Panel, select the SmartRadar FlexLine field device channel.
2. On the Property Panel, expand **Input Publication**.
3. For the channel to be deleted from the publication group, click **None** in the **Channel** drop-down list.
4. Click **Apply**.

## 6.4 Activating SmartRadar FlexLine field device in OneWireless Network

The ISA100 wireless field devices maintain a database of process configuration, identification, and diagnostic information in memory. WDM allows accessing this information from the SmartRadar FlexLine client applications (CIU Prime hardware or Engauge software). This enables monitoring the ISA100 wireless field devices like any other field device.

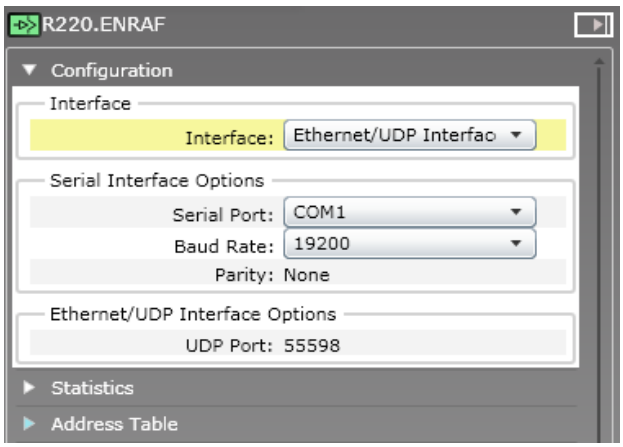
OneWireless Network uses serial communication interface to support data transmission between the applications and the WDM. It also uses Ethernet/UDP interface for data transmission.




### 6.4.1 Activate ENRAF Ethernet UDP interface on OneWireless user interface

**To activate ENRAF Ethernet/UDP interface on the OneWireless user interface**

1. On the Selection Panel, expand the WDM icon and select **ENRAF**.
2. On the Property Panel, expand **Configuration** panel.
3. In the **Interface** list, click **Ethernet/UDP Interface**.



4. Under the **Ethernet/UDP Interface Options**, the UDP port number of the port on which the WDM is connected is displayed.
5. Click **Apply**.

### 6.4.2 Configure CIU Prime and CIU Plus using the Ensite Pro configuration tool

The following details describe the settings for CIU Prime configuration. For more information regarding the Ensite Pro configuration tool, refer to the *Ensite Pro Configuration Tool Instructional manual*.

1. In the **Edit CIU Prime** dialog box, enter the following details in HostPort1 and HostPort2.

   1. Baudrate — Select 19200 as the baudrate from the drop-down list.

   2. Turn-around delay — Enter 10 msec as the turn around delay.

2. In the **CIU Prime — FieldPort Settings** dialog box, enter the following details in FieldPort.

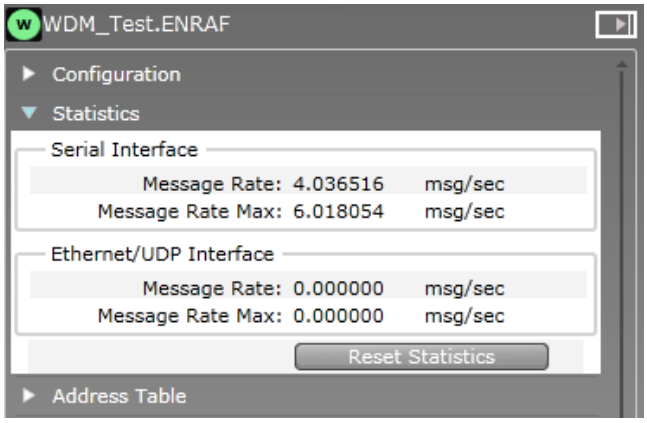
   1.Time-out — Enter 500 msec as the time-out

   2.Retries— Enter 3 as the number of retries.

### 6.4.3 Monitor performance of ENRAF interface

#### To monitor performance of ENRAF interface

1. On the Selection Panel, select the ENRAF interface.
2. On the Property Panel, expand **Statistics**.




3. Verify the following attributes to monitor the performance of the ENRAF interface.
   - **Message Rate**: Number of messages processed by the interface, per second.
   - **Message Rate Max**: Maximum number of messages processed by the interface, per second.
4. Click **Reset Statistics** to reset all the ENRAF interface statistics.

### 6.4.4 Configuring field devices

#### 6.4.4.1 Configure field device properties

**To configure tag name and description**

1. On the Selection Panel, select the field device.
2. On the Property Panel, expand **Field Device Summary**.
3. Type the required **Tag Name**.

*NOTE: You can change the Tag Name by double-clicking the field device name in the Selection Panel.*

4. Type the required **Description**.
5. Click **Apply**.

#### 6.4.4.2 Configure publication rate

The publication data for input and output field devices can be configured using the Input Publication panel in the Property Panel. Depending on the device type, a field device can have an Input Publication panel. This is determined by the DD file for the field device.

The Input Publication panel contains the following configuration options.

- **Contract Status** — A contract is a communication resource (bandwidth) allocation between two devices on the ISA100 network. The following are the status values that are displayed depending on the status of the contract.
  - **Not Configured** - No contract established due to incorrect configuration of the device.
  - **Activating** - Contract establishment is in progress.
  - **Active**- Contract is active.
  - **Active, Negotiated Down** - If a device requests a contract for periodic publications at a fast rate (such as 1 second) and if the communication resources are not available, the contract is negotiated down to a slower publication period (such as 5 seconds).
  - **Terminating** - Contract termination is in progress.
  - **Failed** - Contract establishment is failed.
  - **Inactive** - Contract is inactive.
- **Rate** – The rate at which a field device publishes data.

*NOTE: Honeywell recommends that you set the **Rate** as 10 seconds.*

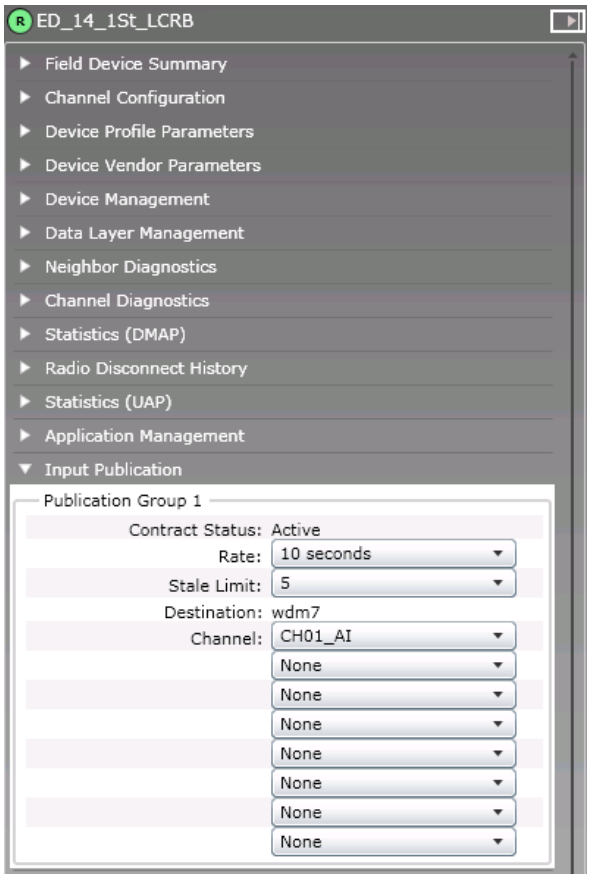
  - **Stale Limit** – Defines the maximum number of stale input values that can be received before the input status is set to Bad. It is recommended that for 1 second publication period, the stale limit should be set to 15. For all other publication periods (5 seconds, 10 seconds, 30 seconds, and 1 minute), the stale limit should be set to 5.

- **Destination** – Destination of publication for output devices .
- **Channel** – The list of channels for which the publication configuration applies.

*NOTE: When a device joins the network, the WDM automatically configures its publication period as 10 seconds.*

### To configure publication rate and stale limit

1. On the Selection Panel, select the field device.
2. On the Property Panel, expand **Input Publication**.




3. In the **Rate** field, select the publication rate, as appropriate.
4. In the **Stale Limit** field, select the stale limit, as appropriate.
5. Click **Apply**.

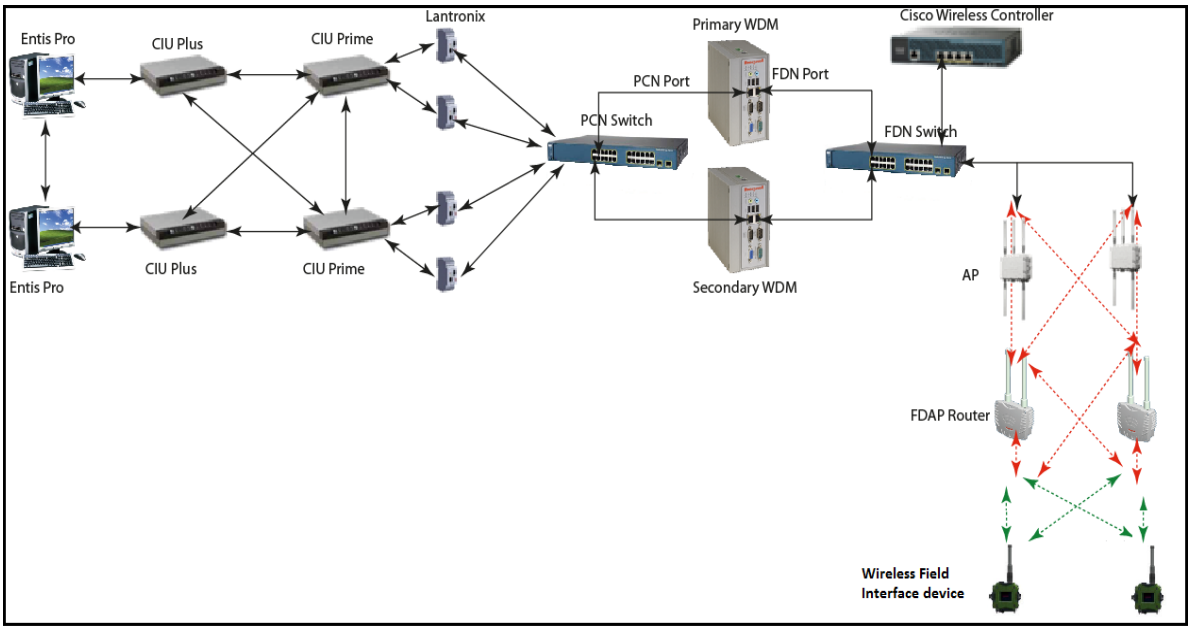
## 6.5 Configuring the protocol tunneling

This release of ISA100 FlexLine R220 supports integration with OneWireless R220. OneWireless R220 WDM supports GPU and Flexconn protocol tunnel. The Applications (Engauge tool/CIU Prime) that support GPU and Flexconn protocol tunnel, communicate with the WDM for configuring and monitoring the ISA100 Flexline R220 devices.

Protocol tunneling can be established for the SmartRadar FlexLine field device in the following two ways.

1. Serial tunneling through RS-232 or RS-485
2. Ethernet/UDP tunnelling

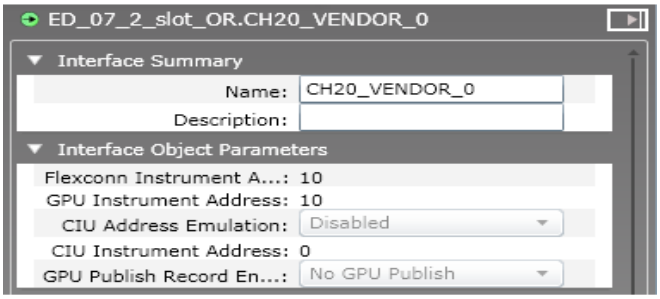
The serial RS-232 is configured on COM1 of the WDM and serial RS-485 is configured on COM2 of the WDM. Redundancy is not supported with the serial RS-232 protocol tunneling. Multiple clients are supported with the Ethernet/ UDP.




### 6.5.1 Configure SmartRadar FlexLine field device interface

**To configure Interface Summary and Interface Object Parameters**

1. On the Selection Panel, select the field device.
2. On the Property Panel, expand **Interface Summary** and **Interface Object Parameters**.




3. Under **Interface Summary**, enter the following read/write parameter details.
   a) **Name** — Type the required name for the channel.
   b) **Description** — Type the required description for the channel.

4. Under **Interface Object Parameters**, The following details are displayed
   a) **Flexconn Instrument Address** — The address of the instrument for FlexConn messages.

*WARNING! Each instrument must have a unique FlexConn address*

   b) **GPU Instrument Address** — The address of the instrument for GPU messages .

*WARNING! Each instrument must have a unique GPU address.*

   c) **CIU Address Emulation** — The status of CIU Address Emulation. **Enabled** or **Disabled.** IF CIU Address Emulation is Enabled, the device will not communicate with CIU Prime, Instead it communicates directly with WDM.
   d) **CIU Instrument Address** — The CIU instrument address.
   e) **GPU Publish Record Enable** — The status of the selected GPU publish record.

### 6.5.2 Configure ENRAF serial interface

To access the field device data, you need to configure the Enraf interface from the OneWireless user interface.

#### Prerequisites

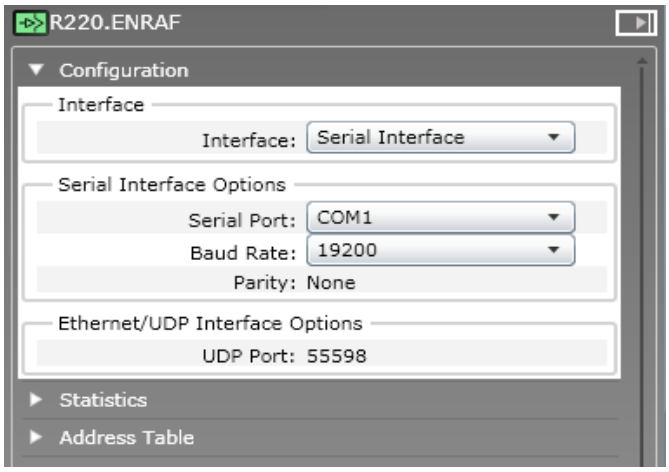
Ensure the following:

- The SmartRadar FlexLine field devices are connected to the WDM using a serial cable.
- The SmartRadar FlexLine field devices are joined in the ISA100 Wireless network.
- The GPU address and the FlexConn address configured for a SmartRadar FlexLine field devices should be unique for each device in the network.
- For more information regarding the GPU address and the FlexConn address, refer to the section 6.5.1 - Configure SmartRadar FlexLine field device interface.
- If RS-232 serial communication is required, then connect the RS-232 serial cable between the COM1 port of the WDM and the client.
- If RS-485 serial communication is required, then connect the RS-485 serial cable between the COM2 port of the WDM and the client.

#### To configure ENRAF serial interface

1. On the Selection Panel, expand the WDM icon and select **ENRAF**.
2. On the Property Panel, expand **Configuration** panel.

3. In the **Interface** list, click **Serial Interface**.




4. Configure the following under **Serial Interface Options**.
   - **Serial Port**: Select the serial port on which the serial cable is connected. The available options are COM1 and COM2.
   - **Baud Rate**: Select **19200** as the baud rate for ENRAF serial interface.
   - **Parity**: This is a read-only parameter and displays the value as **None**.
5. Click **Apply**.

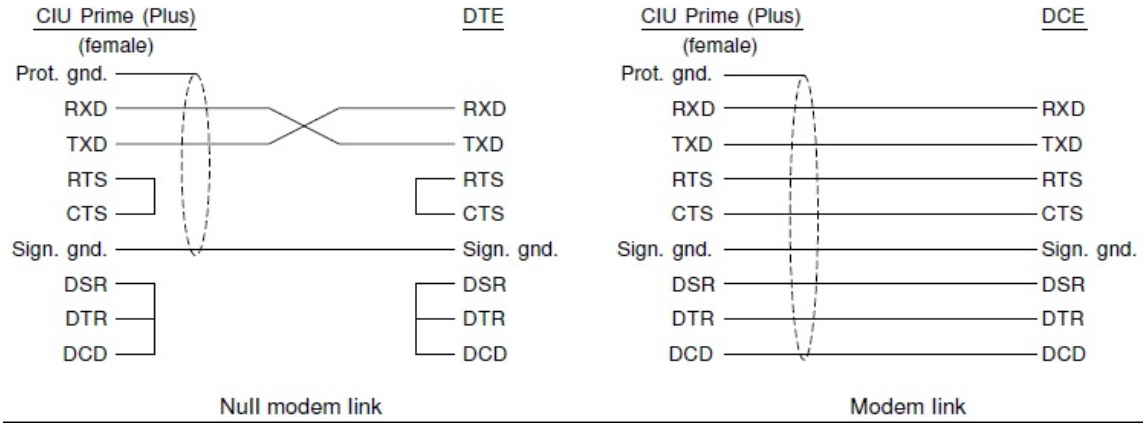
#### 6.5.2.1 Serial interface connection

For serial interface connection, connect a serial cable from the interface client to the serial port on the WDM.

##### *6.5.2.1.1 Rs-232*

For RS-232, select the serial port on which the serial cable is connected as COM1.

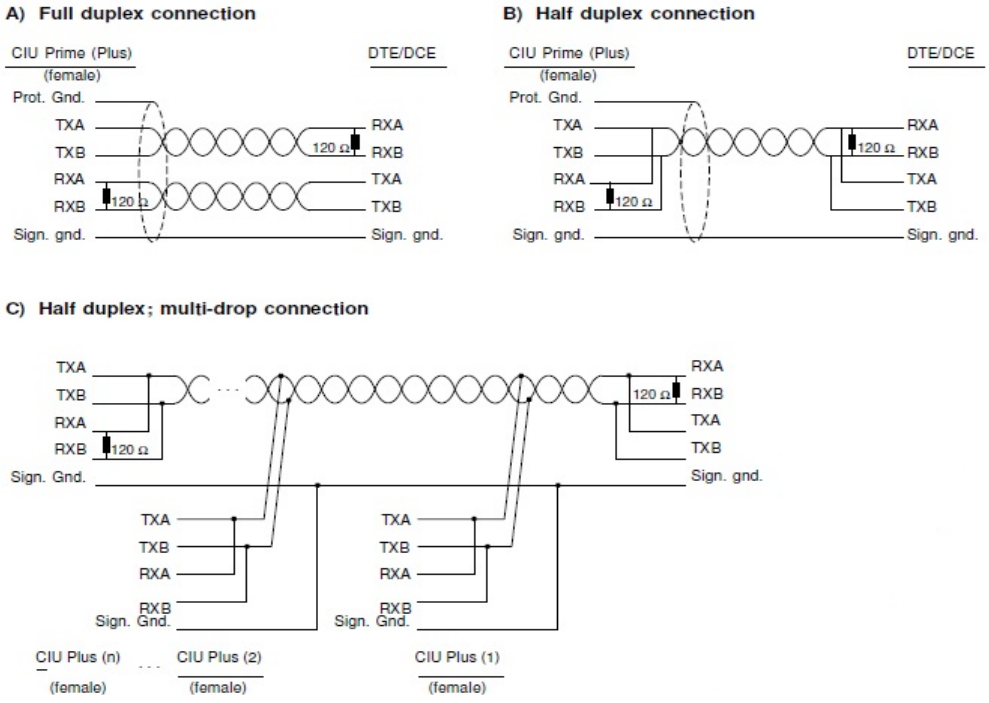
| Signal Name | Pin number | |
|---|---|---|
| | 9 pins | 25 pins |
| Protective ground | Chassis | 1 |
| DCD | 1 | 8 |
| RXD | 2 | 3 |
| TXD | 3 | 2 |
| DTR | 4 | 20 |
| Signal ground | 5 | 7 |
| DSR | 6 | 6 |
| RTS | 7 | 4 |
| CTS | 8 | 5 |




#### *6.5.2.1.2 RS-485*

The Modbus, HART, and SmartRadar FlexLine (ENRAF) interfaces supports RS-485. For RS-485, select the serial port on which the serial cable is connected as COM2.

| Signal Name | Pin number |
|---|---|
| | 9 pins |
| Protective ground | Chassis |
| RXA | 2 |
| RXB | 8 |
| TXA | 3 |
| TXB | 7 |
| Signal ground | 5 |



### 6.5.3 Configure ENRAF Ethernet/UDP interface

You can convert Ethernet/UDP interface by using a Lantronix device or a serial-to-Ethernet/UDP driver.

Following are the high-level tasks to be performed.

- Install and configure the Lantronix device.
- Assign an IP address to the Lantronix device.
- Configure the Standard Serial Tunnel firmware settings on the Lantronix device.
- Activate ENRAF Ethernet/UDP interface on the OneWireless user interface.

#### 6.5.3.1 Install and configure the Lantronix device

Install the Lantronix DeviceInstaller software on the SmartRadar FlexLine client machine using the documentation and media packaged with the device. After installing the DeviceInstaller software, assign an IP address to the Lantronix device.

#### 6.5.3.2 Assign IP address to the Lantronix device

Perform the following steps to assign or reassign an IP address to the Lantronix device.

**To assign or reassign an IP address to the Lantronix device**

1. From the **Start** menu, open **Lantronix DeviceInstaller**.
2. Click **Device** > **Assign IP Address**.
3. When prompted for device identification, enter the **MAC address** of the Lantronix device and click **Next**.

   The MAC address is located on a sticker on the side of the device.
4. When prompted for the assignment method, choose **Assign a specific IP address** to assign a static IP address to the Lantronix device and click **Next**.
5. Enter the **IP address**, **subnet mask**, and **default gateway** for the Lantronix device and click **Next**.
6. Click **Assign**.

   The device now uses the new IP address and has network access.

#### 6.5.3.3 Configure Standard Serial Tunnel settings on the Lantronix device

Configure Standard Serial Tunnel firmware to enable it to properly tunnel SmartRadar FlexLine field device messages from the RS-232 serial port to the Ethernet port of the WDM.

**To configure Standard Serial Tunnel settings on the Lantronix device**

1. From the **Start** menu, open **Lantronix DeviceInstaller**.

2. In the **Lantronix Devices** tree on the left pane, select the Lantronix Xpress-DR or Lantronix Xpress-DR-IAP device name.
3. On the **Telnet Configuration** tab, click **Connect**.
4. When prompted, press **Enter** to go to the setup mode.
5. On the **Main** menu, press **1** on the keyboard to configure channel 1 and set the configuration parameters as follows:
   - Baud Rate = 19200
   - I/F Mode = 4C
   - Flow = 00
   - Port Number = 34568
   - Connect Mode = CC
   - Datagram Mode = 01

     The Remote IP Address can be entered only when the Datagram Mode is set to 01.
   - Remote IP Address = IP Address of the WDM
   - Remote Port = 55598
   - Packet Control = 00
   - Send Character 1 = 00
   - Send Character 2 = 00
6. Press **9** on the keyboard, to save and exit the **Lantronix** main menu.

# CHAPTER 7 COMMISSIONING

## 7.1 General

### 7.1.1 Introduction

This chapter provides an overview of the *commissioning* information as per the FlexConn module.

*NOTE: Not all modules are always present.*

Commissioning a FlexConn module is performed by setting software parameters and the *entities* (see Chapter 3), to the desired specific values. This can either be performed by using *Engauge* or *SmartView* (see Chapter 4).

### 7.1.2 Text Conventions

In contrast with explanatory text, all *instruction* text is preceded by a ☛.

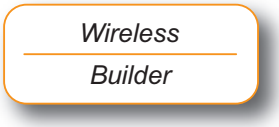
All [Entity] and <entity-related> text is recognizable formatted. When - for instance - all required FlexConn module entities are commissioned, the [Board Commissioned] entity displays <True>. If not, it displays <False>.

All !Command! text is also recognizable formatted, If - for instance - an !Activate! command is given, the result is <Activated>.

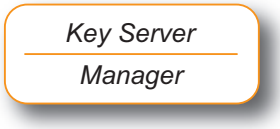
In this chapter, each *commissioning-instruction* text is recognizable by the *Engauge/SmartView icon* in the margin.

When a commissioning instruction or command *cannot* be initiated by *SmartView*, the icon is provided.

When a commissioning instruction or command can only be initiated through *SmartView*, the *SmartView-only button* is visible (left).




In some cases the *Wireless Builder* and/or the *Key Server Manager* application(s) for R120 are used. This is indicated by a corresponding button (left).



## 7.2 Enraf Fieldbus (HCI-BPM)

### 7.2.1 Introduction

The Host Communication Instrument - Bi-Phase Mark (HCI-BPM) board is a communication module for the instrument (gauge).

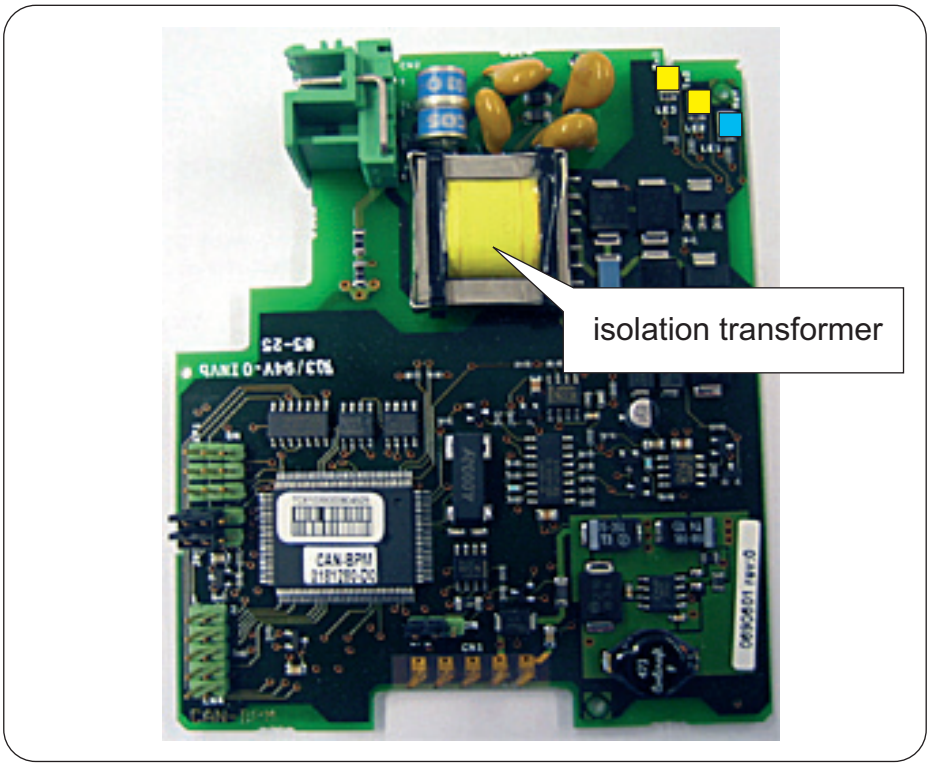



FIGURE 7-1 The HCI-BPM board with its isolation transformer F4A07-0005

As a result of any requirements on the cable quality, the connection of 10 to 15 devices per field bus, and cable lenghts up to 10 km, the Bi-Phase Mark (BPM) signaling is used in many data transmission installations between various instrumentation and Communication Interface Unit (CIU) configurations.

Also, the BPM technology provides excellent protection against lightning. For the exchange of the BPM signals, the HCI-BPM board uses an isolation transformer for galvanic isolation (see FIGURE 7-1). Further protection against heavy lightning is realized by internal ground shields, separated wiring, and ground tracks.

The HCI-BPM module supports the following two protocols

- The Enraf GPU protocol with its records and items (limited);
- The Enraf FlexConn protocol with its entities.

The module can communicate with the following:

- 880 CIU prime
- 858 CIU
- 780 SmartLink

### 7.2.2 Commissioning the HCI-BPM

For a correct functioning of the HCI-BPM module in an instrument (gauge), the following entities can be set by using either *Engauge* or *SmartView*.

*Engauge*
*SmartView*

☛ By using the following table, check each entity for correctness.

| Name | Value Range | Default Value | Explanation |
|---|---|---|---|
| [Baudrate] | <1200><br><2400><br><4800> | <1200> | Communication speed |
| [BPM sensitivity] | <1..8> | <8> | The sensitivity of the receiver circuit.<br>1 = weakest<br>8 = strongest |
| [Identification] | 8 characters for example, <TANK1234> | <--------> | Name of a tank or instrument. |
| [GPU instrument address] | <0..99> | <0> | The address of this instrument for GPU messages.<br>Note: Each instrument must have a unique GPU address. |
| [FlexConn instrument address] | <0..1899> | <0> | The address of this instrument for FlexConn messages.<br>Note: Each instrument must have a unique FlexConn address. |
| [Level units] | <Meters><br><Inches><br><Feet><br><Fractions> | <Meters> | The unit in which level-related GPU records and items are displayed. |
| [Temperature units] | <Celsius><br><Fahrenheit> | <Celsius> | The unit in which temperature-related GPU records and items are displayed. |

| Name | Value Range | Default Value | Explanation |
|---|---|---|---|
| [Pressure units] | <pascal><br><kilo pascal><br><psi small> (2 digits before separator)<br><psi large> (3 digits before separator) | <pascal> | The unit in which pressure-related GPU records and items are displayed. |
| [Density units] | <kilogram m3><br><degrees API><br><pounds ft3> | <kilogram m3> | The unit in which density-related GPU records and items are displayed. |
| [Decimal separator] | <point><br><comma> | <point> | The decimal separator in which GPU-related records and items are displayed. |
| [Level type] | <innage><br><ullage> | <innage> | The level-related GPU records and items can be shown as an innage or ullage.<br>Note:<br>• *Innage* is the level of the product measured from the bottom.<br>• *Ullage* is the level of free space from the roof till the product. |
| [Password] | <.....> 6 characters | <ENRAF2> | Password for entering the protected level.<br>Note: Some settings reside under the protected level. |
| [Function identification] | <.....> 13 characters | <BPM-slave> | The name of the current function of this module. This name is visible on the *SmartView* display. |

☛After having checked/set all before listed entities, make sure you check the following:

- The [Board Commissioned] and the [BPM slave Commissioned] entities are <True>.
- The [Board Health] and the [BPM slave Health] entities are <GOOD>.

## 7.3 Enraf GPU-FlexConn / Modbus Protocol (HCI-GPU)

### 7.3.1 Introduction

The Host Communication Instrument - Gauge Processing Unit (HCI-GPU) board is a communication module for the instrument (gauge).

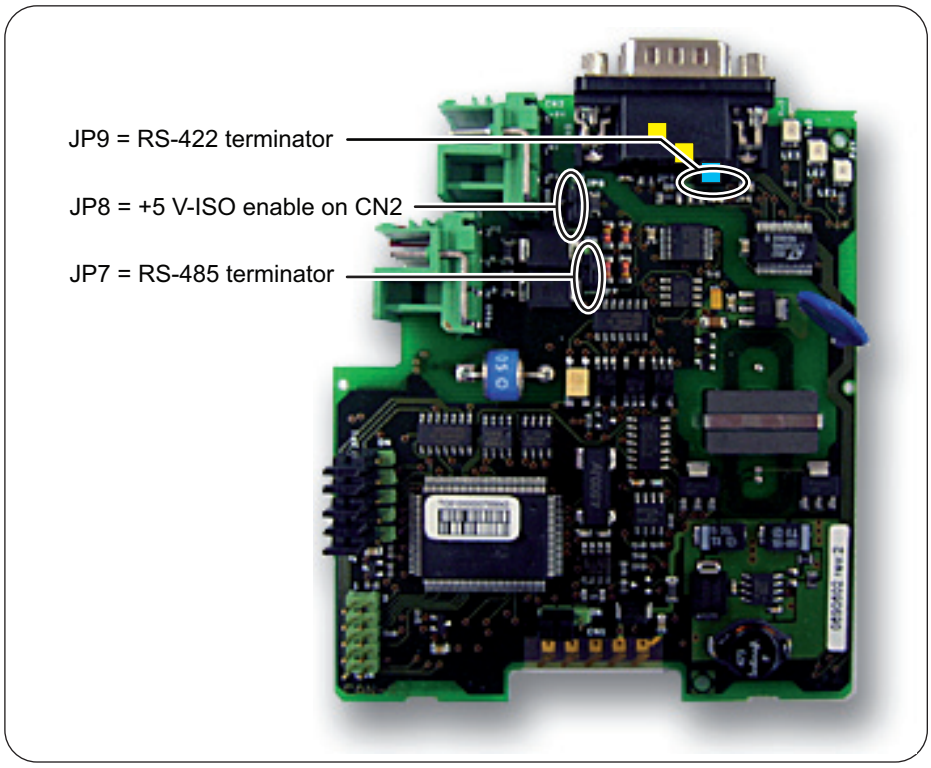



FIGURE 7-2 The HCI-GPU board

The HCI-GPU can communicate with any hosts through three different communication protocols:9

- The Enraf GPU protocol with its records and items (limited)
- The Enraf FlexConn protocol with its entities
- The Modbus protocol

In the first situation the CAN-RS module behaves similar to an Enraf GPU slave, communicating through the Enraf GPU protocol. If a valid record or item is received, a related FlexConn message type A is issued to the CAN-bus for obtaining the desired data.

In the second situation, when production-, test-, configuration-, and service tools are used, the FlexConn protocol must be used through the RS232/485 physical layer.

In the third situation the CAN-RS module behaves similar to a Modbus slave communicating through the Modbus protocol.

*NOTE: A protocol switch has been implemented to switch back and forward between the GPU-FlexConn and the Modbus protocol.*

The physical layers for the communication are RS-232, isolated and non-isolated, and RS-485, isolated. RS-232 is used for direct point-to-point connections whereas RS-485 facilitates a multi-point network with up to 32 drivers and 32 receivers.

The HCI-GPU (slave) module can be used in any field devices provided with the FlexConn architecture.

The Modbus protocols can be used when the SmartRadar FlexLine interfaces to a DCS or SCADA system.

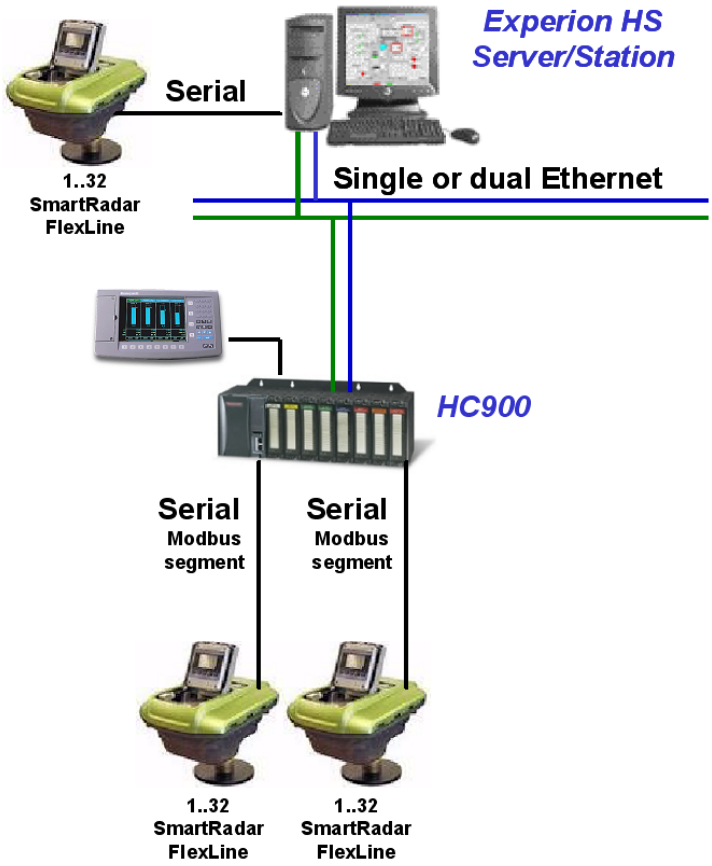



FIGURE 7-3 Typical example of a SmartRadar FlexLine in a Modbus topology

### 7.3.2 Specifications

- **System Specification**:
  - Typical TurnAround Delay (TAD) = 35 ms *
  - Maximum TAD = 65 ms *
  - Refresh rate of 32 FlexLines on one link = 5.76 sec * (@ scan rate of 180 ms)

- Refresh rate of 32 FlexLines on one link = 4.80 sec * (free running host mode: no scan rate setting)

- **Recommended minimum host settings**:
  - Time out >= 65 ms * (assuming time out measurement resets at start of slave message)
  - Scan rate >= 180 ms *

* Note: @ 100 register @ 19K2 baud

### 7.3.3 Commissioning the HCI-GPU - Modbus Protocol

#### 7.3.3.1 Introduction

The Modbus protocol is developed by Modicon and is used to establish master-slave/client-server communication between intelligent devices. Modbus is a *de facto* open standard and the most widely used network protocol in the industrial manufacturing environment.

There are different types of Modbus. The most common is Modbus Remote Terminal Unit (RTU) which is based on serial (twisted pair) communication like RS-485 and RS-232. Honeywell Enraf has implemented this Modbus RTU protocol in its gauges as an option.

With RS-485 communication a bus structure can be built. It is possible to connect a maximum of 32 gauges (as slaves) to one host (master). Each slave has its unique address.

The host (master) initiates the communication by addressing one of the slaves in its query. Only the addressed slave (gauge) responds.

With RS-232 communication there can be only one slave (the gauge) and one master (the host).

#### 7.3.3.2 Modbus Protocol Description

A Modbus message is placed by the transmitting device into a frame that has a known beginning and ending point.This allows receiving devices to begin at the start of the message, read the address portion and determine which device is addressed, and to know when the message is completed.

RTU mode is a binary mode of data representation. Messages start with a silent interval of at least 3.5 character times. This is easily implemented as a multiple of character times at the baud rate that is being used on the network (shown as T1T2T3T4 in next figure).

The first field then transmitted is the device address. The gauges monitor the bus continuously, including during the silent intervals. When the first byte (the address byte) is received, each gauge decodes it to find out if it is the addressed gauge.

Following the last transmitted byte, a similar interval of at least 3.5 character times marks the end of the message. A new message can begin after this interval.

A typical message frame is shown below:

| Start | Address | Function | Data | CRC check | End |
|---|---|---|---|---|---|
| T1T2T3T4 | 8 bits | 8 bits | n * 8 bits | 2 * 8 bits | T1T2T3T4 |

- **Start**: Synchronisation 3.5 character time elapsed.
- **Address**: The address field of a message frame contains eight bits. The address must be in the range 1 to 247 (decimal). A master addresses a slave by placing the slave address in the address field of the message. When the slave sends its response, it places its own address in this address field of the response to let the master know which slave is responding.
- **Function**: The function code field of a message frame contains eight bits. **With the Modbus protocol only function code 03 (read holding registers) and function code 05 (force single coil) are supported.** When a message is sent from a master to a slave the function code field informs the slave the kind of action to perform. For a normal response, the slave simply echoes the original function code.
- **Data**: The data field is constructed using sets of two 8 bit bytes (16 bit registers). The data field of messages sent from a master to slave devices contains additional information which the slave must use to take the action defined by the function code. The data field of a response from a slave to a master contains the requested data.
- **CRC check**: The CRC check field contains a 16-bit value implemented as two eight-bit bytes. The error check value is the result of a **C**yclical **R**edundancy **C**heck (CRC) calculation performed on the message contents. The CRC field is appended to the message as the last field in the message.
- **End**: Synchronization 3.5 character time elapsed.

#### *7.3.3.2.1 Function Codes*

- **Function code 03: Read holding registers**
  Holding registers are located in the memory range (4)0000 ... (4) FFFFH. Register values can range from 0000 to FFFFH. Depending on the use, the registers contain a value or bit coded status in single (16 bit) or double (32 bit) register signed (two=s complement) or not signed.
  - The query message specifies the starting register and quantity of registers to be read:

| Slave address | Function 03 | Start address | No. of registers | CRC check |
|---|---|---|---|---|
| 8 bits | 8 bits | 16 bits | 16 bits | 16 bits |

- The register data in the response message is packed as two bytes:

| Slave address | Function 03 | Byte count (N) | Data | CRC check |
|---|---|---|---|---|
| 8 bits | 8 bits | 8 bits | (N) x 8 bits | 16 bits |

- The amount of bytes N is double the amount of requested registers, because each register occupies two bytes.

| Request | | Response | |
|---|---|---|---|
| *Field Name* | *(Hex)* | *Field Name* | *(Hex)* |
| Function | 03 | Function | 03 |
| Starting Address Hi | 00 | Byte Count | 06 |
| Starting Address Lo | 6B | Register value Hi (108) | 02 |
| No. of Registers Hi | 00 | Register value Lo (108) | 2B |
| No. of Registers Lo | 03 | Register value Hi (109) | 00 |
| | | Register value Lo (109) | 00 |
| | | Register value Hi (110) | 00 |
| | | Register value Lo (110) | 64 |

- **Function code 05 Write single coil**
  Coils are located in the memory range (0)0000 ... (0) FFFFH. The value of a coil can be forced to: FF00H = ON, or 0000H = OFF.
  - The query message specifies the coil reference to be forced:

| Slave address | Function 05 | Coil address | Force data | CRC check |
|---|---|---|---|---|
| 8 bits | 8 bits | 16 bits | 16 bits | 16 bits |

- The normal response is an echo of the query, returned after the coil state has been forced:

| Request | | Response | |
|---|---|---|---|
| *Field Name* | *(Hex)* | *Field Name* | *(Hex)* |
| Function | 05 | Function | 05 |
| Output Address Hi | 00 | Output Address Hi | 00 |
| Output Address Lo | AC | Output Address Lo | AC |
| Output Value Hi | FF | Output Value Hi | FF |
| Output Value Lo | 00 | Output Value Lo | 00 |

| Slave address | Function 05 | Coil address | Force data | CRC check |
|---|---|---|---|---|
| 8 bits | 8 bits | 16 bits | 16 bits | 16 bits |

#### 7.3.3.3 Commisioning Notes

While commissioning, ensure the following:

- For **gauge configuration** --> FlexConn must be used.
- For **data monitoring and certain gauge commands**--> Modbus can be used.
- A changeover is done by the **protocol switch**.

Protocol switching is bound to the following:

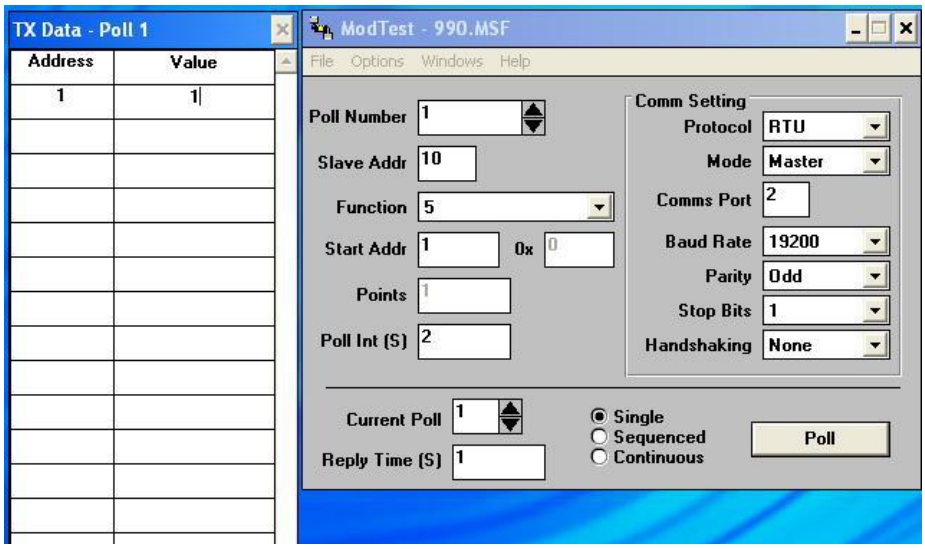
- **Engauge** only supports **GPU-FlexConn to Modbus** switching.
  Once the HCI-GPU is in Modbus mode, Engauge cannot execute any modifications as Engauge does NOT support Modbus communication.
  *This scenario may be found at a first-time installation or during servicing issues.*
- **SmartView** supports **both** GPU-FlexConn to Modbus and Modbus to GPU-FlexConn switching at any time, the actual protocol type being visible real time.
  *Suitable on issues in the field.*
- With the data monitoring the **Modbus host** can issue certain commands such as Overfill test, Reset, Alarm Test, and **Modbus to GPU-FlexConn** switching.
- It is recommended to disconnect the SmartRadar FlexLine from the Modbus communication link when using Engauge with the GPU-FlexConn protocol.

| Using ... | Switching possible from ... |
|---|---|
| Engauge | GPU-FlexConn --> Modbus |
| SmartView | GPU-FlexConn --> Modbus |
| | Modbus --> GPU-FlexConn |
| Modbus command | Modbus --> GPU-FlexConn |

*For example, (with ModTest screen example of Daniel Europe Ltd. below):*

To switch from Modbus to GPU-FlexConn, the following must be performed:

- Set `Function` = `5`; `Address` = `1`; `Value` = `1`.
- Activate by pressing the `Poll` button.



#### 7.3.3.4 Commisioning

For a correct functioning of the HCI-GPU module in an instrument (gauge), the following entities can be set by using either *Engauge* or *SmartView*.

*Engauge*
*SmartView*

☛By using the following table, check each entity for correctness.

| Name | Value Range | Default Value | Explanation |
|---|---|---|---|
| [FlexConn Modbus protocol switch] | <FlexConn><br><Modbus> | <FlexConn-GPU> | If production-, test-, configuration-, and/or service tools are to be used, switch to the FlexConn protocol by selecting <FlexConn-GPU>. |
| [Baudrate] | <1200><br><2400><br><4800><br><9600><br><19200><br><38400><br><57600><br><115200> | <19200> | Communication speed |
| [Turn around delay] | <0..2000 ms> | <0 ms> | The turnaround delay is the minimum time the HCI-GPU waits, before starting to answer the host. |
| [Parity] | <Odd><br><Even><br><None> | <Odd> | User can have different parities depending on the application. |
| <Stopbits> | <1><br><2> | <1> | |
| [Modbus slave address] | <1..247> | <1> | On a site there can be multiple gauges connected through the RS-485 physical link and hence different CAN-RS boards can be identified by unique slave addresses.<br>However, note that RS-485 supports **only 32 devices** in multidrop and so must be the addresses. |

| Name | Value Range | Default Value | Explanation |
|---|---|---|---|
| [Modbus register address offset] | <0x0000..0xEE00> | <0> | As per Modbus, function code 03 supports 0000 to FFFF register addressing. Considering modbus map starting at 0x0000 and 0x1000 and keeping this constant, the offset address should be (0xFFFF - 0x1138 = 0xEEC7). For Round off number 0xEE00. Offset can be moved any where between 0x0000 to 0xEE00. 0x1138 is the total number of registers of both modbus map. |
| [Level units] | <Feet><br><Fractions><br><Inches><br><Meters> | <Meters> | The unit in which level-related records and items are shown. |
| [Temperature units] | <Celsius><br><Fahrenheit> | <Celsius> | The unit in which temperature-related records and items are shown. |
| [Pressure units] | <Kilo Pascal><br><Pascal><br><psi large><br><psi small> | <Pascal> | The unit in which pressure-related records and items are shown. |
| [Density units] | <Degrees API><br><Dimension relative density at 60F><br><kilogram m3><br><pounds ft3> | <kilogram m3> | The unit in which density-related GPU records and items are shown. |
| [Communication type] | <comm ni rs232><br><comm iso rs232><br><comm iso rs485> | <comm ni rs232> | Communication type<br>*NOTE: It must be configured at the GPU slave tab of Engauge. See 7.3.3.* |
| [Function identification] | <.....> 13 characters | <GPU-slave> | The name of the current function of this module. This name is visible on the *SmartView* display. |
| [Function priority] | | | |

#### 7.3.3.5 Modbus Holding Registers

Internal values in a Modbus device are stored in holding registers. These registers are two bytes wide and can be used for various purposes. Some registers contain configuration parameters where

others are used to return measured values (temperatures and so on) to the host.

The holding registers start counting at 40001. They are addressed in the Modbus message structure with addresses starting at 0.

- **Byte order in Modbus registers**

For data type that is long and float IEEE-754, the 32 bits are devided over two 16-bits registers.

Reference:

″ Long and Floating point, IEEE-754 (little endian):

| | |
|---|---|
| address+0 | Byte 1 |
| address+1 | Byte 2 |
| address+2 | Byte 3 |
| address+3 | Byte 4 |

″ Long and Floating point, IEEE-754 **Modbus presentation** (big endian), the word swapped and the byte swapped:

| | |
|---|---|
| Register x | Lo Byte 4 |
| | Hi Byte 3 |
| Register x+1 | Lo Byte 2 |
| | Hi Byte 1 |

- The first table that follows contains all gauge data in **fixed point format** starting at **0x0000**. A **scaling factor** needs to be applied here.
- The second table contains all gauge data in **floating point format** starting at **0x1000**. **No scaling** to be applied here.
  - ″ Floating point: IEEE-754
  - ″ Signed integers: two's complement

#### *7.3.3.5.1 Fixed Point Format Gauge Data*

| Par.no. | Modbus parameter | Modbus address (hex) | Modbus Address (dec) | Data type | No. of registers | Conversion units | Scaling factor | Interpretation |
|---|---|---|---|---|---|---|---|---|
| 1 | Product Level | 0x0000 | SD40001 | long | 2 | METRES | devide by 10000 | |
| | | | | | | FEET | devide by 1000 | |
| | | | | | | INCHES | devide by 100 | |

| Par.no. | Modbus parameter | Modbus address (hex) | Modbus Address (dec) | Data type | No. of registers | Conversion units | Scaling factor | Interpretation |
|---|---|---|---|---|---|---|---|---|
| | ProductLevelStatus | 0x0002 | 40003 | char | 1 | | | See 7.3.3.6.1 |
| | ProductLevelAlarms | 0x0003 | 40004 | char | 1 | | | See 7.3.3.6.13 |
| 2 | Water Level | 0x0004 | SD40005 | long | 2 | METRES | devide by 10000 | |
| | | | | | | FEET | devide by 1000 | |
| | | | | | | INCHES | devide by 100 | |
| | WaterLevelStatus | 0x0006 | 40007 | char | 1 | | | See 7.3.3.6.2 |
| 3 | ProductTemp | 0x0007 | SD40008 | long | 2 | CELSIUS | devide by 100 | |
| | | | | | | FAHRENHEIT | devide by 100 | |
| | ProductTempStatus | 0x0009 | 40010 | char | 1 | | | See 7.3.3.6.3 |
| 4 | VapRoomTemp | 0x000A | SD40011 | long | 2 | CELSIUS | devide by 100 | |
| | | | | | | FAHRENHEIT | devide by 100 | |
| | VapRoomTempStatus | 0x000C | 40013..16 | byte | 4 | | | See 7.3.3.6.4 |
| 5 | VapRoomPress | 0x0010 | SD40017 | long | 2 | PASCAL | multiply by 100 | |
| | | | | | | KILO_PASCAL | devide by 1000 | |
| | | | | | | PSI | devide by 1000 | |
| | VapRoomPressStatus | 0x0012 | 40019..23 | byte | 5 | | | See 7.3.3.6.5 |
| 6 | ObsDensity | 0x0017 | SD40024 | long | 2 | KILOGRAM_PER_M3 | devide by 100 | |
| | | | | | | POUNDS_PER_FT3 | devide by 10000 | |
| | | | | | | DEGREES_API | devide by 1000 | |
| | ObsDensityStatus | 0x0019 | 40026..30 | byte | 5 | | | See 7.3.3.6.6 |
| 7 | Gauge Status | 0x002A | 40043 | byte | 1 | | | See 7.3.3.6.14 |
| 8 | Spot temperature 1 | 0x0200 | SD40513 | long | 2 | CELSIUS | devide by 100 | |
| | | | | | | FAHRENHEIT | devide by 100 | |
| 9 | Spot temperature 1 pos. | 0x0202 | SD40515 | long | 2 | METRES | devide by 10000 | |
| | | | | | | FEET | devide by 1000 | |
| | | | | | | INCHES | devide by 100 | |
| | | | | | | | | |
| 10 | Spot temperature 2 | 0x0204 | SD40517 | long | 2 | CELSIUS | devide by 100 | |
| | | | | | | FAHRENHEIT | devide by 100 | |
| 11 | Spot temperature 2 pos | 0x0206 | SD40519 | long | 2 | METRES | devide by 10000 | |
| | | | | | | FEET | devide by 1000 | |
| | | | | | | INCHES | devide by 100 | |
| 12 | Spot temperature 3 | 0x0208 | SD40521 | long | 2 | CELSIUS | devide by 100 | |
| | | | | | | FAHRENHEIT | devide by 100 | |
| 13 | Spot temperature 3 pos. | 0x020A | SD40523 | long | 2 | METRES | devide by 10000 | |
| | | | | | | FEET | devide by 1000 | |
| | | | | | | INCHES | devide by 100 | |
| 14 | Spot temperature 4 | 0x020C | SD40525 | long | 2 | CELSIUS | devide by 100 | |
| | | | | | | FAHRENHEIT | devide by 100 | |
| 15 | Spot temperature 4 pos. | 0x020E | SD40527 | long | 2 | METRES | devide by 10000 | |
| | | | | | | FEET | devide by 1000 | |
| | | | | | | INCHES | devide by 100 | |
| 16 | Spot temperature 5 | 0x0210 | SD40529 | long | 2 | CELSIUS | devide by 100 | |

| Par.no. | Modbus parameter | Modbus address (hex) | Modbus Address (dec) | Data type | No. of registers | Conversion units | Scaling factor | Interpretation |
|---|---|---|---|---|---|---|---|---|
| | | | | | | FAHRENHEIT | devide by 100 | |
| 17 | Spot temperature 5 pos. | 0x0212 | SD40531 | long | 2 | METRES | devide by 10000 | |
| | | | | | | FEET | devide by 1000 | |
| | | | | | | INCHES | devide by 100 | |
| 18 | Spot temperature 6 | 0x0214 | SD40533 | long | 2 | CELSIUS | devide by 100 | |
| | | | | | | FAHRENHEIT | devide by 100 | |
| 19 | Spot temperature pos. 6 | 0x0216 | SD40535 | long | 2 | METRES | devide by 10000 | |
| | | | | | | FEET | devide by 1000 | |
| | | | | | | INCHES | devide by 100 | |
| 20 | Spot temperature 7 | 0x0218 | SD40537 | long | 2 | CELSIUS | devide by 100 | |
| | | | | | | FAHRENHEIT | devide by 100 | |
| 21 | Spot temperature 7 pos. | 0x021A | SD40539 | long | 2 | METRES | devide by 10000 | |
| | | | | | | FEET | devide by 1000 | |
| | | | | | | INCHES | devide by 100 | |
| 22 | Spot temperature 8 | 0x021C | SD40541 | long | 2 | CELSIUS | devide by 100 | |
| | | | | | | FAHRENHEIT | devide by 100 | |
| 23 | Spot temperature 8 pos. | 0x021E | SD40543 | long | 2 | METRES | devide by 10000 | |
| | | | | | | FEET | devide by 1000 | |
| | | | | | | INCHES | devide by 100 | |
| 24 | Spot temperature 9 | 0x0220 | SD40545 | long | 2 | CELSIUS | devide by 100 | |
| | | | | | | FAHRENHEIT | devide by 100 | |
| 25 | Spot temperature 9 pos. | 0x0222 | SD40547 | long | 2 | METRES | devide by 10000 | |
| | | | | | | FEET | devide by 1000 | |
| | | | | | | INCHES | devide by 100 | |
| 26 | Spot temperature 10 | 0x0224 | SD40549 | long | 2 | CELSIUS | devide by 100 | |
| | | | | | | FAHRENHEIT | devide by 100 | |
| | | | | | | | | |
| 27 | Spot temperature 10 pos. | 0x0226 | SD40551 | long | 2 | METRES | devide by 10000 | |
| | | | | | | FEET | devide by 1000 | |
| | | | | | | INCHES | devide by 100 | |
| 28 | Spot temperature 11 | 0x0228 | SD40553 | long | 2 | CELSIUS | devide by 100 | |
| | | | | | | FAHRENHEIT | devide by 100 | |
| 29 | Spot temperature 11 pos. | 0x022A | SD40555 | long | 2 | METRES | devide by 10000 | |
| | | | | | | FEET | devide by 1000 | |
| | | | | | | INCHES | devide by 100 | |
| 30 | Spot temperature 12 | 0x022C | SD40557 | long | 2 | CELSIUS | devide by 100 | |
| | | | | | | FAHRENHEIT | devide by 100 | |
| 31 | Spot temperature 12 pos. | 0x022E | SD40559 | long | 2 | METRES | devide by 10000 | |
| | | | | | | FEET | devide by 1000 | |
| | | | | | | INCHES | devide by 100 | |
| 32 | Spot temperature 13 | 0x0230 | SD40561 | long | 2 | CELSIUS | devide by 100 | |
| | | | | | | FAHRENHEIT | devide by 100 | |
| 33 | Spot temperature 13 pos. | 0x0232 | SD40563 | long | 2 | METRES | devide by 10000 | |

| Par.no. | Modbus parameter | Modbus address (hex) | Modbus Address (dec) | Data type | No. of registers | Conversion units | Scaling factor | Interpretation |
|---|---|---|---|---|---|---|---|---|
| | | | | | | FEET | devide by 1000 | |
| | | | | | | INCHES | devide by 100 | |
| 34 | Spot temperature 14 | 0x0234 | SD40565 | long | 2 | CELSIUS | devide by 100 | |
| | | | | | | FAHRENHEIT | devide by 100 | |
| 35 | Spot temperature 14 pos. | 0x0236 | SD40567 | long | 2 | METRES | devide by 10000 | |
| | | | | | | FEET | devide by 1000 | |
| | | | | | | INCHES | devide by 100 | |
| 36 | Spot temperature 15 | 0x0238 | SD40569 | long | 2 | CELSIUS | devide by 100 | |
| | | | | | | FAHRENHEIT | devide by 100 | |
| 37 | Spot temperature 15 pos. | 0x023A | SD40571 | long | 2 | METRES | devide by 10000 | |
| | | | | | | FEET | devide by 1000 | |
| | | | | | | INCHES | devide by 100 | |
| 38 | Spot temperature 16 | 0x023C | SD40573 | long | 2 | CELSIUS | devide by 100 | |
| | | | | | | FAHRENHEIT | devide by 100 | |
| 39 | Spot temperature 16 pos. | 0x023E | SD40575 | long | 2 | METRES | devide by 10000 | |
| | | | | | | FEET | devide by 1000 | |
| | | | | | | INCHES | devide by 100 | |
| 40 | Ambient Temperature | 0x0300 | SD40769 | long | 2 | CELSIUS | devide by 100 | |
| | | | | | | FAHRENHEIT | devide by 100 | |
| | Ambient TemperatureStatus | 0x0302 | 40771 | integer | 1 | | | See 7.3.3.6.7 |
| 41 | Product Pressure | 0x0303 | SD40772 | long | 2 | PASCAL | multiply by 100 | |
| | | | | | | KILO_PASCAL | devide by 1000 | |
| | | | | | | PSI | devide by 1000 | |
| | Product PressureStatus | 0x0305 | 40774 | byte | 5 | | | See 7.3.3.6.8 |
| | | | | | | | | |
| | | | | | | | | |
| 42 | Hart Input Variable 1 | 0x030A | SD40779 | long | 2 | METRES | devide by 10000 | |
| | | | | | | FEET | devide by 1000 | |
| | | | | | | INCHES | devide by 100 | |
| | Hart Input Variable 1 Status | 0x030C | 40781 | Integer | 1 | | | See 7.3.3.6.9 |
| 43 | Hart Input Variable 2 | 0x030D | SD40782 | long | 2 | CELSIUS | devide by 100 | |
| | | | | | | FAHRENHEIT | devide by 100 | |
| | Hart Input Variable 2 Status | 0x030F | 40784 | Integer | 1 | | | See 7.3.3.6.9 |
| 44 | Hart Input Variable 3 | 0x0310 | SD40785 | long | 2 | PASCAL | multiply by 100 | |
| | | | | | | KILO_PASCAL | devide by 1000 | |
| | | | | | | PSI | devide by 1000 | |
| | Hart Input Variable 3 status | 0x0312 | 40787 | Integer | 1 | | | See 7.3.3.6.9 |
| 45 | Hart Input Variable 4 | 0x0313 | SD40788 | long | 2 | KILOGRAM_PER_M3 | devide by 100 | |
| | | | | | | POUNDS_PER_FT3 | devide by 10000 | |
| | | | | | | DEGREES_API | devide by 1000 | |

| Par.no. | Modbus parameter | Modbus address (hex) | Modbus Address (dec) | Data type | No. of registers | Conversion units | Scaling factor | Interpretation |
|---|---|---|---|---|---|---|---|---|
| | Hart Input Variable 4 status | 0x0315 | 40790 | Integer | 1 | | | See 7.3.3.6.9 |
| 46 | Hart Input Variable 5 | 0x0316 | SD40791 | long | 2 | Free format | devide by 100 | |
| | Hart Input Variable 5 status | 0x0318 | 40793 | Integer | 1 | | | See 7.3.3.6.9 |
| 47 | First Relay Board - Relay 1 | 0x0319 | SD40794 | long | 2 | | | |
| | First Relay Board - Relay 1 Status | 0x031B | 40796 | Integer | 1 | | | See 7.3.3.6.10 |
| 48 | First Relay Board - Relay 2 | 0x031C | SD40797 | long | 2 | | | |
| | First Relay Board - Relay 2 Status | 0x031E | 40799 | Integer | 1 | | | See 7.3.3.6.10 |
| 49 | First Relay Board - Relay 3 | 0x031F | SD40800 | long | 2 | | | |
| | First Relay Board - Relay 3 Status | 0x0321 | 40802 | Integer | 1 | | | See 7.3.3.6.10 |
| 50 | First Relay Board - Relay 4 | 0x0322 | SD40803 | long | 2 | | | |
| | First Relay Board - Relay 4 Status | 0x0324 | 40805 | Integer | 1 | | | See 7.3.3.6.10 |
| 51 | Second Relay Board - Relay 1 | 0x0325 | SD40806 | long | 2 | | | |
| | Second Relay Board - Relay 1 Status | 0x0327 | 40808 | Integer | 1 | | | See 7.3.3.6.10 |
| 52 | Second Relay Board - Relay 2 | 0x0328 | SD40809 | long | 2 | | | |
| | Second Relay Board - Relay 2 Status | 0x032A | 40811 | Integer | 1 | | | See 7.3.3.6.10 |
| 53 | Second Relay Board - Relay 3 | 0x032B | SD40812 | long | 2 | | | |
| | Second Relay Board - Relay 3 Status | 0x032D | 40814 | Integer | 1 | | | See 7.3.3.6.10 |
| 54 | Second Relay Board - Relay 4 | 0x032E | SD40815 | long | 2 | | | |
| | Second Relay Board - Relay 4 Status | 0x0330 | 40817 | Integer | 1 | | | See 7.3.3.6.10 |
| 55 | Overfill Protection Status First Relay Board | 0x0331 | 40818 | char | 1 | | | See 7.3.3.6.12 |
| 56 | Overfill Protection Status Second Relay Board | 0x0332 | 40819 | char | 1 | | | |
| 57 | Safety ShutDown Timer Left First Relay Board | 0x0333 | 40820 | Integer | 1 | | | |
| 58 | Safety ShutDown Timer Left Second Relay Board | 0x0334 | 40821 | Integer | 1 | | | |
| 59 | Analog Output | 0x0335 | SD40822 | long | 2 | N.A. | devide by 100 | |
| | Analog OutputStatus | 0x0337 | 40824 | integer | 1 | | | See 7.3.3.6.11 |
| 60 | Tank Identification | 0x0338 | 40825 | char | 8 | N.A. | | |

| Par.no. | Modbus parameter | Modbus address (hex) | Modbus Address (dec) | Data type | No. of registers | Conversion units | Scaling factor | Interpretation |
|---|---|---|---|---|---|---|---|---|
| 61 | GPU Device Number | 0x0340 | 40833 | integer | 1 | | | |

#### *7.3.3.5.2 Floating Point Format Gauge Data*

| Par.no. | Modbus parameter | Modbus address (hex) | Modbus Address (dec) | Data type | No. of registers | Conversion units | Interpretation |
|---|---|---|---|---|---|---|---|
| 1 | ProductLevel | 0x1000 | SD44097 | floating point | 2 | METRES | |
| | | | | | | FEET | |
| | | | | | | INCHES | |
| | ProductLevelStatus | 0x1002 | 44099 | char | 1 | | See 7.3.3.6.1 |
| | ProductLevelAlarms | 0x1003 | 44100 | char | 1 | | See 7.3.3.6.13 |
| 2 | WaterLevel | 0x1004 | SD44101 | floating point | 2 | METRES | |
| | | | | | | FEET | |
| | | | | | | INCHES | |
| | WaterLevelStatus | 0x1006 | 44103 | char | 1 | | See 7.3.3.6.2 |
| 3 | ProductTemp | 0x1007 | SD44104 | floating point | 2 | CELSIUS | |
| | | | | | | FAHRENHEIT | |
| | ProductTempStatus | 0x1009 | 44106 | char | 1 | | See 7.3.3.6.3 |
| 4 | VapRoomTemp | 0x100A | SD44107 | floating point | 2 | CELSIUS | |
| | | | | | | FAHRENHEIT | |
| | VapRoomTempStatus | 0x100C | 44109..12 | byte | 4 | | See 7.3.3.6.4 |
| 5 | VapRoomPress | 0x1010 | SD44113 | floating point | 2 | PASCAL | |
| | | | | | | KILO_PASCAL | |
| | | | | | | PSI | |
| | VapRoomPressStatus | 0x1012 | 44115..19 | byte | 5 | | See 7.3.3.6.5 |
| 6 | ObsDensity | 0x1017 | SD44120 | floating point | 2 | KILOGRAM_PER_M3 | |
| | | | | | | POUNDS_PER_FT3 | |
| | | | | | | DEGREES_API | |
| | ObsDensityStatus | 0x1019 | 44122..26 | byte | 5 | | See 7.3.3.6.6 |
| 7 | Gauge Status | 0x102A | 44139 | byte | 1 | | See 7.3.3.6.14 |

| Par.no. | Modbus parameter | Modbus address (hex) | Modbus Address (dec) | Data type | No. of registers | Conversion units | Interpretation |
|---|---|---|---|---|---|---|---|
| 8 | Spot temperature 1 | 0x1200 | SD44609 | floating point | 2 | CELSIUS | |
| | | | | | | FAHRENHEIT | |
| 9 | Spot temperature 1 pos. | 0x1202 | SD44611 | floating point | 2 | METRES | |
| | | | | | | FEET | |
| | | | | | | INCHES | |
| 10 | Spot temperature 2 | 0x1204 | SD44613 | floating point | 2 | CELSIUS | |
| | | | | | | FAHRENHEIT | |
| 11 | Spot temperature 2 pos. | 0x1206 | SD44615 | floating point | 2 | METRES | |
| | | | | | | FEET | |
| | | | | | | INCHES | |
| 12 | Spot temperature 3 | 0x1208 | SD44617 | floating point | 2 | CELSIUS | |
| | | | | | | FAHRENHEIT | |
| 13 | Spot temperature 3 pos. | 0x120A | SD44619 | floating point | 2 | METRES | |
| | | | | | | FEET | |
| | | | | | | INCHES | |
| 14 | Spot temperature 4 | 0x120C | SD44621 | floating point | 2 | CELSIUS | |
| | | | | | | FAHRENHEIT | |
| 15 | Spot temperature 4 pos. | 0x120E | SD44623 | floating point | 2 | METRES | |
| | | | | | | FEET | |
| | | | | | | INCHES | |
| 16 | Spot temperature 5 | 0x1210 | SD44625 | floating point | 2 | CELSIUS | |
| | | | | | | FAHRENHEIT | |
| 17 | Spot temperature 5 pos. | 0x1212 | SD44627 | floating point | 2 | METRES | |
| | | | | | | FEET | |
| | | | | | | INCHES | |
| 18 | Spot temperature 6 | 0x1214 | SD44629 | floating point | 2 | CELSIUS | |
| | | | | | | FAHRENHEIT | |
| 19 | Spot temperature 6 pos. | 0x1216 | SD44631 | floating point | 2 | METRES | |
| | | | | | | FEET | |
| | | | | | | INCHES | |
| | | | | | | | |
| | | | | | | | |
| 20 | Spot temperature 7 | 0x1218 | SD44633 | floating point | 2 | CELSIUS | |

| Par.no. | Modbus parameter | Modbus address (hex) | Modbus Address (dec) | Data type | No. of registers | Conversion units | Interpretation |
|---|---|---|---|---|---|---|---|
| | | | | | | FAHRENHEIT | |
| 21 | Spot temperature 7 pos. | 0x121A | SD44635 | floating point | 2 | METRES | |
| | | | | | | FEET | |
| | | | | | | INCHES | |
| 22 | Spot temperature 8 | 0x121C | SD44637 | floating point | 2 | CELSIUS | |
| | | | | | | FAHRENHEIT | |
| 23 | Spot temperature 8 pos. | 0x121E | SD44639 | floating point | 2 | METRES | |
| | | | | | | FEET | |
| | | | | | | INCHES | |
| 24 | Spot temperature 9 | 0x1220 | SD44641 | floating point | 2 | CELSIUS | |
| | | | | | | FAHRENHEIT | |
| 25 | Spot temperature 9 pos. | 0x1222 | SD44643 | floating point | 2 | METRES | |
| | | | | | | FEET | |
| | | | | | | INCHES | |
| 26 | Spot temperature 10 | 0x1224 | SD44645 | floating point | 2 | CELSIUS | |
| | | | | | | FAHRENHEIT | |
| 27 | Spot temperature 10 pos. | 0x1226 | SD44647 | floating point | 2 | METRES | |
| | | | | | | FEET | |
| | | | | | | INCHES | |
| 28 | Spot temperature 11 | 0x1228 | SD44649 | floating point | 2 | CELSIUS | |
| | | | | | | FAHRENHEIT | |
| 29 | Spot temperature 11 pos. | 0x122A | SD44651 | floating point | 2 | METRES | |
| | | | | | | FEET | |
| | | | | | | INCHES | |
| 30 | Spot temperature 12 | 0x122C | SD44653 | floating point | 2 | CELSIUS | |
| | | | | | | FAHRENHEIT | |
| 31 | Spot temperature 12 pos. | 0x122E | SD44655 | floating point | 2 | METRES | |
| | | | | | | FEET | |
| | | | | | | INCHES | |
| 32 | Spot temperature 13 | 0x1230 | SD44657 | floating point | 2 | CELSIUS | |
| | | | | | | FAHRENHEIT | |
| 33 | Spot temperature 13 pos. | 0x1232 | SD44659 | floating point | 2 | METRES | |
| | | | | | | FEET | |

| Par.no. | Modbus parameter | Modbus address (hex) | Modbus Address (dec) | Data type | No. of registers | Conversion units | Interpretation |
|---|---|---|---|---|---|---|---|
| | | | | | | INCHES | |
| 34 | Spot temperature 14 | 0x1234 | SD44661 | floating point | 2 | CELSIUS | |
| | | | | | | FAHRENHEIT | |
| 35 | Spot temperature 14 pos. | 0x1236 | SD44663 | floating point | 2 | METRES | |
| | | | | | | FEET | |
| | | | | | | INCHES | |
| 36 | Spot temperature 15 | 0x1238 | SD44665 | floating point | 2 | CELSIUS | |
| | | | | | | FAHRENHEIT | |
| | | | | | | | |
| 37 | Spot temperature 15 pos. | 0x123A | SD44667 | floating point | 2 | METRES | |
| | | | | | | FEET | |
| | | | | | | INCHES | |
| 38 | Spot temperature 16 | 0x123C | SD44669 | floating point | 2 | CELSIUS | |
| | | | | | | FAHRENHEIT | |
| 39 | Spot temperature 16 pos. | 0x123E | SD44671 | floating point | 2 | METRES | |
| | | | | | | FEET | |
| | | | | | | INCHES | |
| 40 | Ambient Temperature | 0x1300 | SD44865 | floating point | 2 | CELSIUS | |
| | | | | | | FAHRENHEIT | |
| | Ambient TemperatureStatus | 0x1302 | 44867 | integer | 1 | | See 7.3.3.6.7 |
| 41 | Product Pressure | 0x1303 | SD44868 | floating point | 2 | PASCAL | |
| | | | | | | KILO_PASCAL | |
| | | | | | | PSI | |
| | Product Pressure Status | 0x1305 | 44870 | byte | 5 | | See 7.3.3.6.5 |
| 42 | Hart Input Variable 1 | 0x130A | SD44875 | floating point | 2 | METRES | |
| | | | | | | FEET | |
| | | | | | | INCHES | |
| | Hart Input Variable 1 Status | 0x130C | 44877 | Integer | 1 | | See 7.3.3.6.9 |
| 43 | Hart Input Variable 2 | 0x130D | SD44878 | floating point | 2 | CELSIUS | |
| | | | | | | FAHRENHEIT | |
| | Hart Input Variable 2 Status | 0x130F | 44880 | Integer | 1 | | See 7.3.3.6.9 |
| 44 | Hart Input Variable 3 | 0x1310 | SD44881 | floating point | 2 | PASCAL | |

| Par.no. | Modbus parameter | Modbus address (hex) | Modbus Address (dec) | Data type | No. of registers | Conversion units | Interpretation |
|---|---|---|---|---|---|---|---|
| | | | | | | KILO_PASCAL | |
| | | | | | | PSI | |
| | Hart Input Variable 3 status | 0x1312 | 44883 | Integer | 1 | | See 7.3.3.6.9 |
| 45 | Hart Input Variable 4 | 0x1313 | SD44884 | floating point | 2 | KILOGRAM_PER_M3 | |
| | | | | | | POUNDS_PER_FT3 | |
| | | | | | | DEGREES_API | |
| | Hart Input Variable 4 status | 0x1315 | 44886 | Integer | 1 | | See 7.3.3.6.9 |
| 46 | Hart Input Variable 5 | 0x1316 | SD44887 | floating point | 2 | Free format | |
| | Hart Input Variable 5 status | 0x1318 | 44889 | Integer | 1 | | See 7.3.3.6.9 |
| 47 | First Relay Board - Relay 1 | 0x1319 | SD44890 | floating point | 2 | | |
| | First Relay Board - Relay 1 Status | 0x131B | 44892 | Integer | 1 | | See 7.3.3.6.10 |
| 48 | First Relay Board - Relay 2 | 0x131C | SD44893 | floating point | 2 | | |
| | First Relay Board - Relay 2 Status | 0x131E | 44895 | Integer | 1 | | See 7.3.3.6.10 |
| 49 | First Relay Board - Relay 3 | 0x131F | SD44896 | floating point | 2 | | |
| | First Relay Board - Relay 3 Status | 0x1321 | 44898 | Integer | 1 | | See 7.3.3.6.10 |
| 50 | First Relay Board - Relay 4 | 0x1322 | SD44899 | floating point | 2 | | |
| | First Relay Board - Relay 4 Status | 0x1324 | 44901 | Integer | 1 | | See 7.3.3.6.10 |
| 51 | Second Relay Board - Relay 1 | 0x1325 | SD44902 | floating point | 2 | | |
| | Second Relay Board - Relay 1 Status | 0x1327 | 44904 | Integer | 1 | | See 7.3.3.6.10 |
| 52 | Second Relay Board - Relay 2 | 0x1328 | SD44905 | floating point | 2 | | |
| | Second Relay Board - Relay 2 Status | 0x132A | 44907 | Integer | 1 | | See 7.3.3.6.10 |
| 53 | Second Relay Board - Relay 3 | 0x132B | SD44908 | floating point | 2 | | |
| | Second Relay Board - Relay 3 Status | 0x132D | 44910 | Integer | 1 | | See 7.3.3.6.10 |
| 54 | Second Relay Board - Relay 4 | 0x132E | SD44911 | floating point | 2 | | |
| | Second Relay Board - Relay 4 Status | 0x1330 | 44913 | Integer | 1 | | See 7.3.3.6.10 |
| 55 | Overfill Protection Status First Relay Board | 0x1331 | 44914 | char | 1 | | See 7.3.3.6.12 |

| Par.no. | Modbus parameter | Modbus address (hex) | Modbus Address (dec) | Data type | No. of registers | Conversion units | Interpretation |
|---|---|---|---|---|---|---|---|
| 56 | Overfill Protection Status Second Relay Board | 0x1332 | 44915 | char | 1 | | See 7.3.3.6.12 |
| 57 | Safety Shutdown Timer Left First Relay Board | 0x1333 | 44916 | Integer | 1 | | |
| 58 | Safety Shutdown Timer Left Second Relay Board | 0x1334 | 44917 | Integer | 1 | | |
| 59 | Analog Output | 0x1335 | SD44918 | floating point | 2 | N.A. | |
| | Analog Output Status | 0x1337 | 44920 | integer | 1 | | See 7.3.3.6.11 |
| 60 | Tank Identification | 0x1338 | 44921 | char | 8 | N.A. | |
| 61 | GPU Device Number | 0x1340 | 44929 | integer | 1 | | |

#### 7.3.3.6 Status Information

After being requested by the host, the slave returns the relevant status information. The following tables provide the possible received status bytes from the relevant registers, such as product level, product temperature and so on.

For a listing of ASCII codes, see 7.3.4 - Standard ASCII codes.

##### *7.3.3.6.1 Product Level*

This register contains the bit-coded product level status. This status information is coded such that an ASCII code for a character is generated. The ASCII characters are listed below.

| Product Level status | Meaning |
|---|---|
| F | invalid level data |
| C | out of measuring range |
| B | measurement blocked |
| M | warning |
| ? | reduced accuracy |
| - | valid product level |

##### *7.3.3.6.2 Water Level*

This register contains the bit-coded water level status. This status information is coded such that an ASCII code for a character is generated. The ASCII characters are listed below.

| Water Level status | Meaning |
|---|---|
| F | invalid water alarm data |
| A | water above probe warning |

| Water Level status | Meaning |
|---|---|
| Z | water below probe warning |
| - | valid water level |

#### 7.3.3.6.3 *Product Temperature*

This register contains the bit-coded product temperature status. This status information is coded such that an ASCII code for a character is generated. The ASCII characters are listed below.

| Product Temperature status | Meaning |
|---|---|
| F | invalid temperature alarm data |
| T | reduced accuracy |
| - | valid data |

#### 7.3.3.6.4 *Vapour Room Temperature*

Four registers contains the bit-coded Vapour room temperature status. With exception of the first register, the status information is coded such that an ASCII code for a character is generated. The 8-bits ASCII coded character is placed in the Low byte of the register; the High byte remains empty (zero).

| Vapour Room Temperature status | Meaning |
|---|---|
| 0 | Indicates the highest immersed (spot) element of the temperature element |
| 1 | bit 0 - General temperature fail<br>1 - Fail in average product temperature<br>2 - Fail in average Vapour temperature<br>3 - Level exceeds lowest (spot)element<br>4 - Level exceeds highest (spot)element<br>5 - (Spot)element fail<br>6 - one<br>7 - zero |
| 2 | bit 0 - Last valid level used<br>1 - Manual level used<br>2 - Level time out<br>3 - Device not calibrated (MTT)<br>4 - Exceeding differential temp. range (MTT)<br>5 - Out of specified temperature range<br>6 - one<br>7 - zero |
| 3 | bit 0 - No previous store command<br>1 - Alternative element selected (MRT)<br>2-5 - zero<br>6 - one<br>7 - zero |

#### 7.3.3.6.5 *Vapour Room Pressure*

Five registers contain the bit-coded Vapour room pressure and observed density status. The status information is coded such that an ASCII code for a character is generated. The 8-bits ASCII coded character is placed in the Low byte of the register; the High byte remains empty (zero).

| Vapour Room Pressure status | Meaning |
|---|---|
| 0 | bit 0 - General option board fail<br>1 - Low level alarm<br>2 - Low low level alarm<br>3 - High level alarm<br>4 - High high level alarm<br>5 - Level time out<br>6 - one<br>7 - zero |
| 1 | bit 0 - P1 exceeds min. / max. trip pressure<br>1 - P2 exceeds min. / max. trip pressure<br>2 - P3 exceeds min. / max. trip pressure<br>3 - Exceeding range P1<br>4 - Exceeding range P2<br>5 - Exceeding range P3<br>6 - one<br>7 - zero |
| 2 | bit 0 - Fail P1<br>1 - Fail P2<br>2 - Fail P1<br>3 - Manual P3 used<br>4 - Last valid P3 used<br>5 - Manual level used<br>6 - one<br>7 - zero |
| 3 | bit 0 - Last valid density used<br>1 - Manual density used<br>2 - High density alarm<br>3 - Low density used<br>4 - HTG level fail<br>5 - No previous store command<br>6 - one<br>7 - zero |
| 4 | bit 0 - Manual gas density used<br>1 - Level below LN<br>2 - Last valid level used<br>3 - Invalid level reading<br>4 - API underflow/overflow or negative density<br>5 - zero<br>6 - one<br>7 - zero |

#### 7.3.3.6.6 *Observed Density*

See 7.3.3.6.5 - Vapour Room Pressure.

#### 7.3.3.6.7 *Ambient Temperature*

| Health status code | Meaning |
|---|---|
| 2561 | LOWEST_ELEMENT_OFFSET_NOT_COMMISSIONED |
| 2562 | MRT_ELEMENT_LENGTH_NOT_COMMISSIONED |
| 2563 | MEASUREMENT_TYPE_NOT_COMMISSIONED |
| 2564 | ELEMENT_TYPE_NOT_COMMISSIONED |
| 2565 | NUMBER_OF_ELEMENTS_NOT_COMMISSIONED |
| 2566 | SECOND_ELEMENT_OFFSET_NOT_COMMISSIONED |
| 2567 | SENSOR_LENGTH_NOT_COMMISSIONED |
| 2568 | RTD_ELEMENT_POSITION_NOT_COMMISSIONED |
| 2569 | RTD_CONFIGURATION_NOT_COMMISSIONED |
| 2570 | MULTI_ELEMENT_OPTION_NOT_COMMISSIONED |
| 2571 | DYNAMIC_EXCLUSION_NR_OF_ELEMENTS_NOT_COMMISSIONED |
| 2572 | LOW_ELEMENT_USAGE_MEASUREMENT_TYPE_NOT_COMMISIONED |
| 2573 | TEMPERATURE_ELEMENT_EXCLUDE_ZONE_NOT_COMMISSIONED |
| 2574 | SMOOTHING_LEVEL_NOT_COMMISSIONED |
| 2575 | R_ELEMENT_SHORTCUT |
| 2576 | R_ELEMENT_NOT_CONNECTED |
| 2577 | T_ELEMENT_OUT_OF_RANGE |
| 2578 | ELEMENT_IN_WATER |
| 2579 | ELEMENT_FAIL |
| 2580 | NO_VALID_PRODUCT_LEVEL |
| 2581 | ELEMENT_SKIPPING |
| 2582 | NO_RELEVANT_ELEMENTS |
| 2583 | LEVEL_BELOW_LOWEST_ELEMENT |
| 2584 | NO_LAST_VALID_VALUE_AVAILABLE |
| 2585 | LEVEL_BELOW_TEMP_EXCLUDE_ZONE |
| 2586 | LEVEL_IN_TEMP_EXCLUDE_ZONE |
| 2587 | R_CABLE_OUT_OF_LIMITS |
| 2588 | R_TEST_OUT_OF_LIMITS |
| 2589 | VCC1_OUT_OF_LIMITS |
| 2590 | R_ELEMENT_INVALID_VALUE |
| 2591 | VOLTAGE_MON_PRIMARY_CIRCUIT_LO_LIM_EXCEEDED |
| 2592 | VOLTAGE_MON_PRIMARY_CIRCUIT_HI_LIM_EXCEEDED |
| 2593 | PROBE_RANGE_NOT_COMMISSIONED |
| 2594 | PROBE_OUT_OF_WNM_RANGE |

| Health status code | Meaning |
|---|---|
| 2596 | PRODUCT_LEVEL_NO_STATUS_CATEGORY_GOOD_ACTUAL |

#### *7.3.3.6.8 Product Pressure*

See 7.3.3.6.5 - Vapour Room Pressure.

#### *7.3.3.6.9 HART variable*

| Health status code | Meaning |
|---|---|
| 1536 | MORE_STATUS_AVAILABLE |
| 1537 | PV_OUT_OF_LIMITS |
| 1538 | SV_OR_TV_OUT_OF_LIMITS |
| 1539 | DEVICE_MALFUNCTION |
| 1540 | WRONG_PV_UNIT_CODE |
| 1541 | SCAN_INITIALIZING |
| 1542 | PRODUCT_LEVEL_SCAN_ERROR |
| 1543 | P1_NOT_INSTALLED |
| 1544 | P3_NOT_INSTALLED |
| 1545 | NO_P1_AVAILABLE |
| 1546 | NO_P3_AVAILABLE |
| 1547 | UNCERTAIN_P1 |
| 1548 | UNCERTAIN_P3 |
| 1549 | MANUAL_P1_USED |
| 1550 | MANUAL_P3_USED |
| 1551 | LAST_VALID_P3_USED |
| 1552 | NO_MANUAL_OR_LAST_VALID_P3 |
| 1553 | NO_PRODUCT_LEVEL_AVAILABLE |
| 1554 | UNCERTAIN_PRODUCT_LEVEL |
| 1555 | PRODUCT_LEVEL_BELOW_MINIMUM_HIMS |
| 1556 | LAST_VALID_PRODUCT_LEVEL_USED |
| 1557 | MANUAL_PRODUCT_LEVEL_USED |
| 1558 | NO_WATER_LEVEL_AVAILABLE |
| 1559 | UNCERTAIN_WATER_LEVEL |
| 1560 | LAST_VALID_WATER_LEVEL_USED |
| 1561 | WATER_LEVEL_ABOVE_P1 |

| Health status code | Meaning |
|---|---|
| 1562 | NEGATIVE_DENSITY_CALCULATED |
| 1563 | NO_MANUAL_OR_LAST_VALID_DENSITY |
| 1564 | MANUAL_WATER_LEVEL_USED |
| 1565 | DENSITY_OPTION_NOT_ENABLED |
| 1566 | P1_ERROR |
| 1567 | P3_ERROR |
| 1568 | G1_ERROR |
| 1569 | G2_ERROR |
| 1570 | G3_ERROR |
| 1571 | G4_ERROR |
| 1572 | G5_ERROR |
| 1573 | DENSITY_ERROR |
| 1574 | P1_UNCERTAIN |
| 1575 | P3_UNCERTAIN |
| 1576 | G1_UNCERTAIN |
| 1577 | G2_UNCERTAIN |
| 1578 | G3_UNCERTAIN |
| 1579 | G4_UNCERTAIN |
| 1580 | G5_UNCERTAIN |
| 1581 | DENSITY_UNCERTAIN |
| 1582 | TOO_MANY_HART_DEVICES_DETECTED |
| 1583 | WATER_LEVEL_SCAN_ERROR |

#### *7.3.3.6.10 Relay*

| Health status code | Meaning |
|---|---|
| 2305 | RELAY_TEST_FAILED |
| 2307 | PV_SCAN_VALUE_BAD |
| 2308 | PV_SCAN_VALUE_UNCERTAIN |
| 2309 | INVALID_MESSAGE_LENGTH |
| 2310 | NACK_CODE_RECEIVED |
| 2311 | ERROR_REQUESTING_ENTITY |
| 2312 | NO_BOARD_AVAILABLE |
| 2313 | ERROR_RELAY_1 |
| 2314 | ERROR_RELAY_2 |
| 2315 | ERROR_RELAY_3 |
| 2316 | ERROR_RELAY_4 |
| 2317 | LICENSE_NOT_SET |
| 2318 | REDUNDANT_BOARD_ERROR |
| 2319 | XBAND_OVERFILL_DISABLED |
| 2320 | NOT_COMMISSIONED |
| 2321 | BOARD_HEALTH_BAD |
| 2322 | REDUNDANT_BOARD_HEALTH_BAD |
| 2323 | REDUNDANT_BOARD_COM_FAIL |
| 2324 | SAFETY_TIMER_EXPIRED |
| 2325 | COMMISSIONING_MISMATCH |
| 2326 | RELAY_MODE_NOT_COMMISSIONED |
| 2327 | XBAND_BOARD_MISSING |
| 2328 | XBAND_LEVEL_BAD |
| 2329 | ALARM_MODE_NOT_COMMISSIONED |
| 2330 | MONITOR_BOARD_PARAMETERS_NOT_COMMISSIONED |

#### 7.3.3.6.11 *Analog Output*

| Health status code | Meaning |
|---|---|
| 2817 | CALIBRATION_SET_POINTS_NOT_CALIBARTED |
| 2818 | POLLING_ADDRESS_SET_TO_NON_ZERO |
| 2819 | DAC_READ_BACK_FAIL |
| 2820 | AO_INITIALIZING |
| 2821 | BURNOUT_VALUE_OUT_OF_RANGE |
| 2822 | ANAOUT_FIXED_AT_4MA |
| 2823 | MULTI_DROP_MODE |
| 2824 | TUNNEL_FAILED_IN_GETTING_AN_ENTITY |
| 2825 | TUNNEL_FAILED_IN_PUTTING_AN_ENTITY |
| 2826 | UNITS_NOT_SELECTED |
| 2827 | LINKED_PV_NOT_SET |
| 2828 | LINKED_SV_NOT_SET |
| 2829 | LINKED_TV_NOT_SET |
| 2830 | LINKED_QV_NOT_SET |
| 2831 | PV_UNIT_CODE_NOT_SELECTED |
| 2832 | RANGE_VALUES_NOT_SELECTED |
| 2833 | PV_OUT_OF_LIMITS |
| 2834 | UPPER_TRANSDUCER_LIMIT_NOT_SET |
| 2835 | TRANSDUCER_SERIAL_NUMBER_NOT_SET |
| 2836 | UNABLE_TO_GET_LINKED_VARIABLE |
| 2837 | UPPER_RANGE_VALUE_GREATER_THAN_UPPER_TRANSDUCER_LIMIT |
| 2838 | LOWER_RANGE_VALUE_LESS_THAN_LOWER_TRANSDUCER_LIMIT |

#### 7.3.3.6.12 *Overfill Protection Status*

For a listing of ASCII codes, see 7.3.4 - Standard ASCII codes.

| Overfill Protection status | Meaning |
|---|---|
| O | Overfill |
| W | Warning |
| H | Healthy |

#### *7.3.3.6.13 Alarms*

| Product Level Alarm status | Meaning |
|---|---|
| 0 | no alarm |
| 1 | Low level product alarm tripped |
| 2 | High level product alarm tripped |
| 3 | Low low level product alarm tripped |
| 4 | High high level product alarm tripped |
| 255 | alarm failure |

#### *7.3.3.6.14 Gauge Status*

The following table lists the Gauge status information and the description.

| Gauge status (decimal) | Meaning |
|---|---|
| 0 | Level gauge is measuring level |
| 255 | Level gauge is in failure |

### 7.3.3.7 Modbus Coils

The following table lists Modbus commands and their related addresses (coils) and data.

| Modbus command | Modbus address (hex) | Modbus address (dec) | Data | Number of registers |
|---|---|---|---|---|
| FlexConn Modbus Protocol Switch | 0x00 | 00001 | 0xFF00 | 1 |
| Reset Device | 0x10 | 00017 | 0xFF00 | 1 |
| Product Level Alarm Test Hi Hi | 0x11 | 00018 | 0xFF00 | 1 |
| Product Level Alarm Test Hi | 0x12 | 00019 | 0xFF00 | 1 |
| Product Level Alarm Test Lo | 0x13 | 00020 | 0xFF00 | 1 |
| Product Level Alarm Test Lo Lo | 0x14 | 00021 | 0xFF00 | 1 |
| Start Proof Test First Relay Board | 0x15 | 00022 | 0xFF00 | 1 |
| Stop Proof Test First Relay Board | 0x16 | 00023 | 0xFF00 | 1 |
| Start Proof Test Second Relay Board | 0x17 | 00024 | 0xFF00 | 1 |
| Stop Proof Test Second Relay Board | 0x18 | 00025 | 0xFF00 | 1 |

*NOTE: Coils are names for memory addresses. Also, coils are pre-defined variable names. A coil is a boolean (bit) variable, and a register is an integer (word) variable.*

### 7.3.3.8 Modbus Exception Handling

When a Modbus master device sends a request to a FlexLine device, it expects a normal response. One of four possible events can occur from the master's query:

- If the FlexLine device receives the request without a communication error, and can handle the query normally, it returns a normal response.
- If the FlexLine device does not receive the request due to a communication error, no response is returned. The master program eventually processes a timeout condition for the request. Typically 2 retries are carried out before going into fail.
- If the FlexLine device receives the request, but detects a communication error (parity, LRC, CRC), no response is returned. The master program eventually processes a timeout condition for the request.
- If the FlexLine device receives the request without a communication error, but cannot handle it (for example, if the request is to read a non–existent output or register), the FlexLine device will return an exception response informing the master of the nature of the error.

The exception-response message have two fields that differentiate it from a normal response:

- **Function** code field:
  In a normal response, the FlexLine device echoes the function code of the original request in the function code field of the response. All function codes have a most–significant bit (MSB) of 0 (their values are all below 80 hexadecimal). In an exception response, the FlexLine device sets the MSB of the function code to 1. This makes the function code value in an exception response exactly 80 hexadecimal higher than the value would be for a normal response.
  With the function code's MSB set, the master's application program can recognize the exception response and can examine the data field for the exception code.
- **Data** field:
  In a normal response, the FlexLine device may return data or statistics in the data field (any information that was requested in the request). In an exception response, the FlexLine device returns an exception code in the data field. This defines the FlexLine device condition that caused the exception.

| Code | Name | Meaning |
|---|---|---|
| 01 | Illegal Function | The function code received in the query is not an allowable action for the FlexLine device. This may be because the function code is only applicable to newer devices, and was not implemented in the unit selected. It could also indicate that the FlexLine device is in the wrong state to process a request of this type, for example, because it is unconfigured and is being asked to return register values. |

| Code | Name | Meaning |
|---|---|---|
| 02 | Illegal Data Address | The data address received in the query is not an allowable address for the FlexLine device. More specifically, the combination of reference number and transfer length is invalid. |
| 03 | Illegal Data Value | A value contained in the query data field is not an allowable value for FlexLine device. |

### 7.3.4 Standard ASCII codes

| Dec | Oct | Hex | Binair | Code | Dec | Oct | Hex | Binair | Code | Dec | Oct | Hex | Binair | Code |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 32 | 040 | 20 | 0100000 | SP | 64 | 100 | 40 | 1000000 | @ | 96 | 140 | 60 | 1100000 | ` |
| 33 | 041 | 21 | 0100001 | ! | 65 | 101 | 41 | 1000001 | A | 97 | 141 | 61 | 1100001 | a |
| 34 | 042 | 22 | 0100010 | " | 66 | 102 | 42 | 1000010 | B | 98 | 142 | 62 | 1100010 | b |
| 35 | 043 | 23 | 0100011 | # | 67 | 103 | 43 | 1000011 | C | 99 | 143 | 63 | 1100011 | c |
| 36 | 044 | 24 | 0100100 | $ | 68 | 104 | 44 | 1000100 | D | 100 | 144 | 64 | 1100100 | d |
| 37 | 045 | 25 | 0100101 | % | 69 | 105 | 45 | 1000101 | E | 101 | 145 | 65 | 1100101 | e |
| 38 | 046 | 26 | 0100110 | & | 70 | 106 | 46 | 1000110 | F | 102 | 146 | 66 | 1100110 | f |
| 39 | 047 | 27 | 0100111 | ' | 71 | 107 | 47 | 1000111 | G | 103 | 147 | 67 | 1100111 | g |
| 40 | 050 | 28 | 0101000 | ( | 72 | 110 | 48 | 1001000 | H | 104 | 150 | 68 | 1101000 | h |
| 41 | 051 | 29 | 0101001 | ) | 73 | 111 | 49 | 1001001 | I | 105 | 151 | 69 | 1101001 | i |
| 42 | 052 | 2A | 0101010 | * | 74 | 112 | 4A | 1001010 | J | 106 | 152 | 6A | 1101010 | j |
| 43 | 053 | 2B | 0101011 | + | 75 | 113 | 4B | 1001011 | K | 107 | 153 | 6B | 1101011 | k |
| 44 | 054 | 2C | 0101100 | , | 76 | 114 | 4C | 1001100 | L | 108 | 154 | 6C | 1101100 | l |
| 45 | 055 | 2D | 0101101 | - | 77 | 115 | 4D | 1001101 | M | 109 | 155 | 6D | 1101101 | m |
| 46 | 056 | 2E | 0101110 | . | 78 | 116 | 4E | 1001110 | N | 110 | 156 | 6E | 1101110 | n |
| 47 | 057 | 2F | 0101111 | / | 79 | 117 | 4F | 1001111 | O | 111 | 157 | 6F | 1101111 | o |
| 48 | 060 | 30 | 0110000 | 0 | 80 | 120 | 50 | 1010000 | P | 112 | 160 | 70 | 1110000 | p |
| 49 | 061 | 31 | 0110001 | 1 | 81 | 121 | 51 | 1010001 | Q | 113 | 161 | 71 | 1110001 | q |
| 50 | 062 | 32 | 0110010 | 2 | 82 | 122 | 52 | 1010010 | R | 114 | 162 | 72 | 1110010 | r |
| 51 | 063 | 33 | 0110011 | 3 | 83 | 123 | 53 | 1010011 | S | 115 | 163 | 73 | 1110011 | s |
| 52 | 064 | 34 | 0110100 | 4 | 84 | 124 | 54 | 1010100 | T | 116 | 164 | 74 | 1110100 | t |
| 53 | 065 | 35 | 0110101 | 5 | 85 | 125 | 55 | 1010101 | U | 117 | 165 | 75 | 1110101 | u |
| 54 | 066 | 36 | 0110110 | 6 | 86 | 126 | 56 | 1010110 | V | 118 | 166 | 76 | 1110110 | v |
| 55 | 067 | 37 | 0110111 | 7 | 87 | 127 | 57 | 1010111 | W | 119 | 167 | 77 | 1110111 | w |
| 56 | 070 | 38 | 0111000 | 8 | 88 | 130 | 58 | 1011000 | X | 120 | 170 | 78 | 1111000 | x |
| 57 | 071 | 39 | 0111001 | 9 | 89 | 131 | 59 | 1011001 | Y | 121 | 171 | 79 | 1111001 | y |
| 58 | 072 | 3A | 0111010 | : | 90 | 132 | 5A | 1011010 | Z | 122 | 172 | 7A | 1111010 | z |
| 59 | 073 | 3B | 0111011 | ; | 91 | 133 | 5B | 1011011 | [ | 123 | 173 | 7B | 1111011 | { |
| 60 | 074 | 3C | 0111100 | < | 92 | 134 | 5C | 1011100 | \ | 124 | 174 | 7C | 1111100 | \| |
| 61 | 075 | 3D | 0111101 | = | 93 | 135 | 5D | 1011101 | ] | 125 | 175 | 7D | 1111101 | } |
| 62 | 076 | 3E | 0111110 | > | 94 | 136 | 5E | 1011110 | ^ | 126 | 176 | 7E | 1111110 | ~ |
| 63 | 077 | 3F | 0111111 | ? | 95 | 137 | 5F | 1011111 | _ | 127 | 177 | 7F | 1111111 | DEL |

## 7.4 The OneWireless Communication Option (HCI-1WL) - Double slot (for R120)

### 7.4.1 Introduction

The Host Communication Instrument OneWireless (HCI-1WL) board is a communication module for the instrument (gauge).

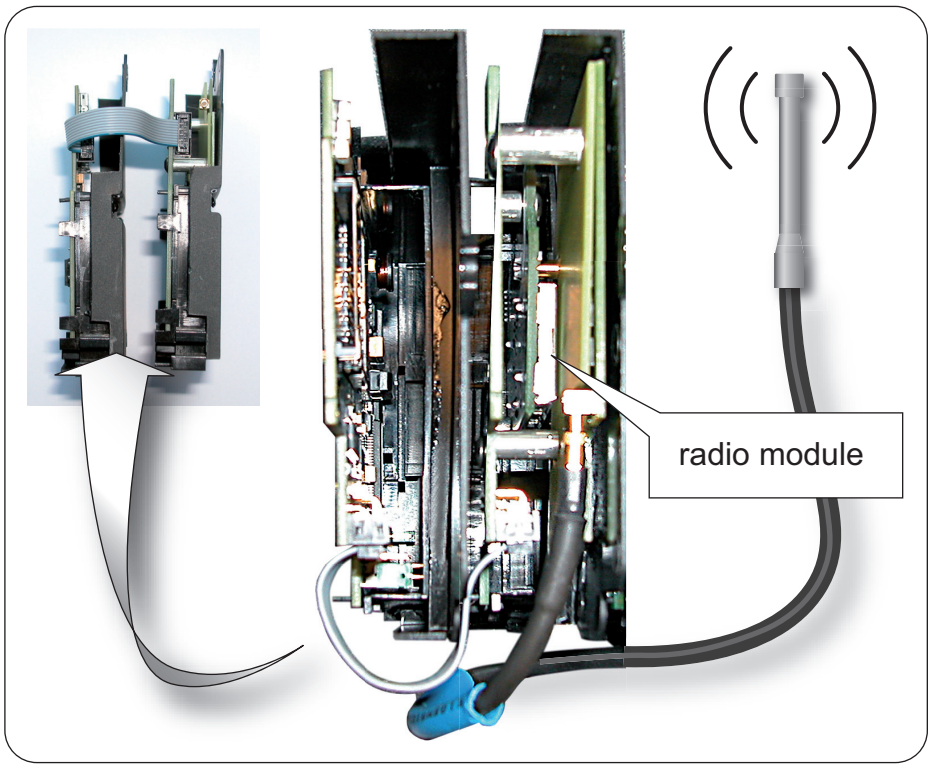



FIGURE 7-4 The HCI-1WL duplex board with flatcable interconnection F4A09-0011

This module consists of two boards (see FIGURE 7-6): a standard FlexConn board with a memory-card interface, and an interface board with a standard Honeywell OneWireless Radio board attached. If this wireless communication option is installed, the Instrument (gauge) can communicate with a host system using the OneWireless network through three different ways :

- Directly through the OneWireless Network (using the HCI-1WL board).
- By using a *protocol tunnel* through the OneWireless network:
  - Through the Enraf FlexConn protocol.
  - Through the Enraf GPU protocol.

*OneWireless* is an all digital, two-way communication mesh network that interconnects industrial field sensors to a central system.

OneWireless has defined standards to which field devices and operator stations communicate with one another. The communications protocol is built as an "open system" to allow all field devices and equipment that are built to the OneWireless standard to be integrated into a system, regardless of the device manufacturer. This interoperability of devices using OneWireless technology is to become an industry standard for automation systems.

In the OneWireless network, devices like the Smartradar FlexLine publish their measuring values autonomously at the network. Through an OPC server connected to gateway(s), the data is made available for further use.

The Honeywell Enraf GPU and FlexConn protocols are implemented for communication with Honeywell Enraf Tank Inventory Software systems. For example, Entis Pro, Entis XL, and Entis XS. Additionally, these protocols enable communication with configuration and diagnostic tools such as *Engauge*. These protocols are implemented in the same way as in the HCI-GPU and HCI-BPM. Therefore, they only support the same limited set of GPU records and items.

### 7.4.2 Potential Electrostatic Charging Hazard

*WARNING! Do NOT wipe the surface of the antenna with dry cloth, and do NOT clean its surface with a solvent.*

*If electrostatically charged, discharge the antenna surface to a person or a tool that could ignite a surrounding hazardous atmosphere.*

### 7.4.3 Adding a Radar to the OneWireless Network

#### 7.4.3.1 Introduction

Before a radar is visible in the OneWireless network, it must be supplied with a correct network security key, so it is allowed to join the protected wireless network.

You must be properly trained in Honeywell OneWireless solutions before adding the SmartRadar in a OneWireless network. To establish communication with the OneWireless network the *Key Server Manager* and *Wireless Builder (R120 or later)* tools are required. Refer to the respective manuals for details.

*CAUTION! **France** restricts outdoor use to 10mW (10 dBm) EIRP in the frequency range of 2,454-2,483.5 MHz. Installations in France must limit EIRP to 10 dBm for operating modes utilizing frequencies in the range of 2,454 – 2,483.5MHz. For this reason, Honeywell Enraf does not recommend configuring frequency hopping modes that use this frequency range.*

***For installations in France, use only the following OneWireless Frequency Hopping (FH) Mode Selections:** EU Channel #1, EU Channel #7, NA/EU*

*Guard Bands and NA/EU Channel 3 (FH Mode selections #4, 5, 8 and 10).*

#### 7.4.3.2 Preparing the Radar

Before adding a radar to a one wireless network, old security information must be removed from the radar. To prevent this from happening by accident, this functionality is only available through the *SmartView*. To erase the security information:

~~*Engauge*~~
*SmartView*

1. Go to [Menu] > [Commands]
2. Enter the password
3. Go to the HCI-1WL
4. Select [Board] and issue the [Restore Default] command.

#### 7.4.3.3 Authentication

*Key Server Manager*

1. Ensure the OneWireless Network is operational, including running Key Server Manager (KSM) software, and at least 1 multi-node configured as gateway.
2. Use the KSM to write security information to a memory card. See the Key Server Manager manual for instructions on how to use the key server. For a sample screen, see FIGURE 7-5.
3. Insert the memory card into the memory card slot of the HCI-1WL device.
4. Make sure to fully close the device if it is installed in an explosion hazardous area.
5. Switch on the device

The device will now automatically join the OneWireless network.

You can follow the authentication/joining process by navigating to the correct page on the *SmartView*, see 7.5.7.1. Or by using *Engauge*, see 7.5.8.1, if there is also a wired connection available.

If the message [NOREDUN] or [CONNECT] does NOT become visible, the authentication failed.

☛ If authentication failed, verify that the wireless network is operating correctly, and try again with a new security key.

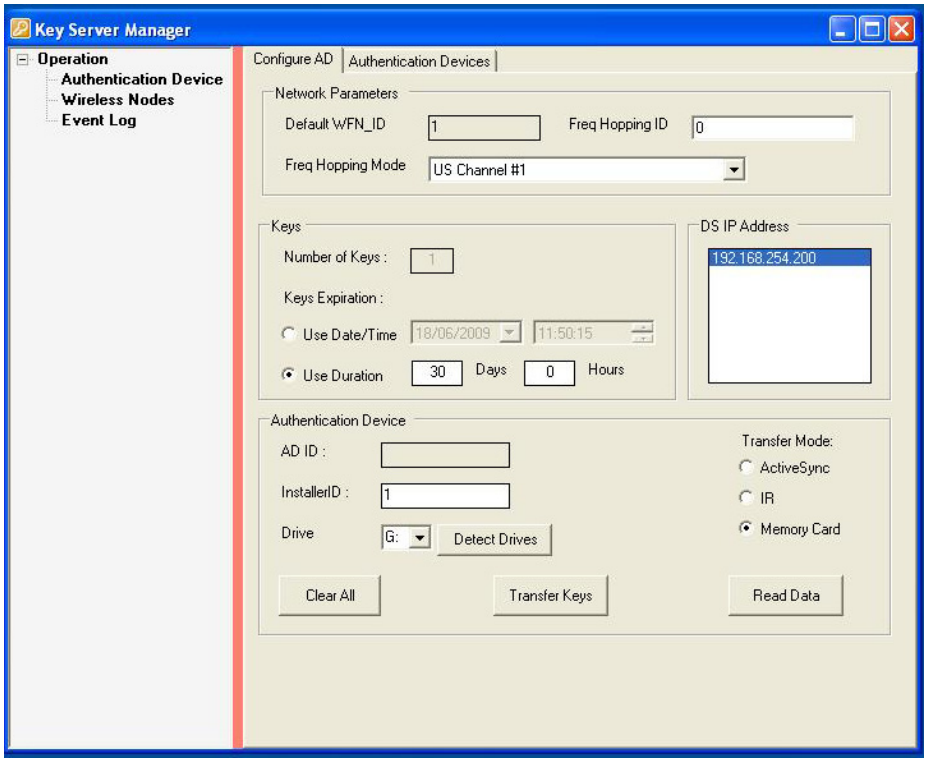
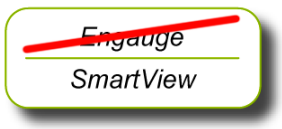



FIGURE 7-5 Sample screen of the Key Server Manager

### 7.4.4 Removing a Radar From the OneWireless Network

To remove a radar from a OneWireless Network, the security key information must be removed from the radar. To prevent this from happening by accident, this functionality is only available throuugh the *SmartView*.

To erase the security key information:




1. Go to [Menu] > [Commands]
2. Enter the password
3. Go to the HCI-1WL
4. Select [Board] and issue the [Restore Default] command.

### 7.4.5 Commissioning the HCI-1WL in the OneWireless Network for R120

#### 7.4.5.1 Introduction

When the authentication process is completed, the SmartRadar can be commissioned in the OneWireless network.

Before you continue with this step, ***familiarize yourself with the Wireless Builder configuration tool*** for the OneWireless network. For a detailed operation guide for the Wireless Builder, Refer to the ***OneWireless Wireless Builder User's Guide, R120***.

With the Wireless Builder you can create, delete, commission, load, and unload the SmartRadar just like any other OneWireless devices. You can also activate and inactivate transducer blocks, and program the different parameters, such as publication period, as with any other devices.

Once the Authentication process has been successfully completed, the SmartRadar automatically is listed in the *Online* window of Wireless Builder as an *uncommissioned device*.

Right-click the device to commission it as described in the Wireless Builder manual.

By default, the SmartRadar contains *one transducer block, Radar Level*.

More transducer blocks can be added, during further commissioning.

### 7.4.5.2 Transducer Blocks for R120

#### *7.4.5.2.1 Introduction*

Besides the Radar Level transducer block, up to 16 additional transducer blocks can be added to the device through the Wireless Builder. This can easily be performed by using the *"drag and drop"* method.

The specific parameters for all the available transducer blocks can be set through the Wireless Builder. This section describes the procedures to use the Configuration Form to configure the transducer blocks (channels).

Refer to the *Configuring Channels* chapter in the OneWireless manual for more information. ***This Transducer Blocks section only explains the additional or non-standard items.***

#### *7.4.5.2.2 Adding Transducer Blocks*

To configure each channel, you must add transducer blocks to this device.

*Wireless Builder*

☛ Expand the device template in the *Library* tree (click +), to view all the available transducer blocks.

☛ Drag and drop the transducer block(s) that must be instantiated (= made concrete) from the Library tree to the device in the *Offline* tree.

*NOTE: Each transducer block can only be added to the instrument **once**.*

☛ After adding the relevant transducer block(s), load the device to *activate* the transducer blocks.

*NOTE: Refer to the Block instantiation in the OneWireless Wireless builder User's Guide for more information.*

The following additional transducer blocks are available.

| Transducer Block | See section |
|---|---|
| Product level | - |
| Ambient temp | - |
| Average product temperature | - |
| Configurable Transducer block 1 | 7.4.5.2.5 |
| Configurable Transducer block 2 | |
| Configurable Transducer block 3 | |
| Configurable Transducer block 4 | |
| Observed Density | - |
| Product pressure | - |

| Transducer Block | See section |
|---|---|
| Relay output 1 | 7.4.5.2.7 |
| Relay output 2 | |
| Relay output 3 | |
| Relay output 4 | |
| Temperature Details | 7.4.5.2.6 |
| Vapour pressure | - |
| Vapour temperature | - |
| Water level | - |

All Transducer blocks can be loaded for any SmartRadars. However, a transducer block provides only valid data when a relevant option is installed in the SmartRadar.

For a temperature transducer blocks to be available, an FII-RTD or FII-VT must be installed in the SmartRadar and for the Relay output transducer blocks to work accurately, an FII-DO must be installed, and so on.

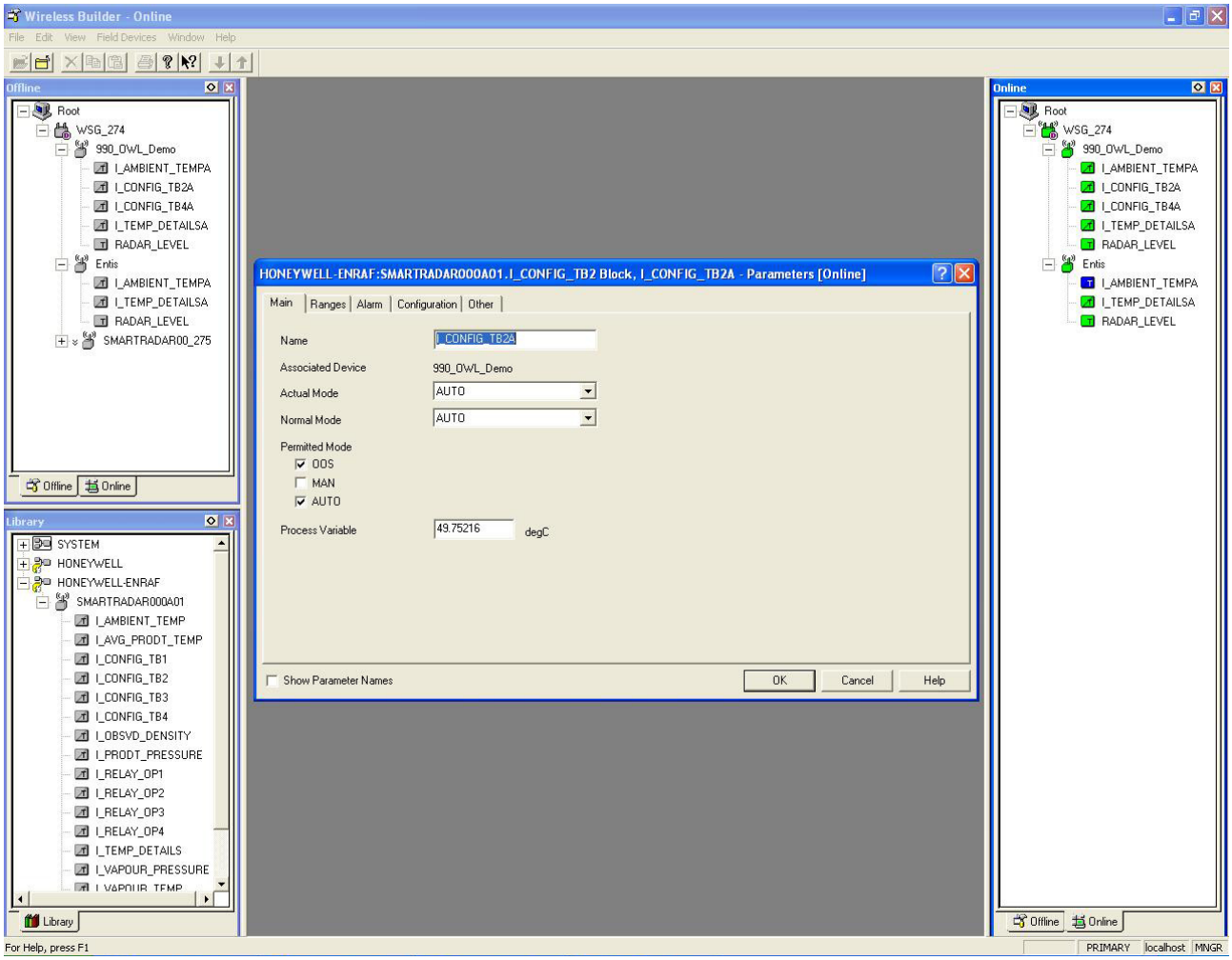
#### *7.4.5.2.3 General Transducer Block Settings*

Click the transducer block of an instrument in the *Online* window. A window appears with the details for this particular transducer block.

#### 7.4.5.2.4 *Wireless Builder Screens*

##### 7.4.5.2.4.1 *Main Tab*

The Main Tab contains the general settings of the Transducer Block (TB).

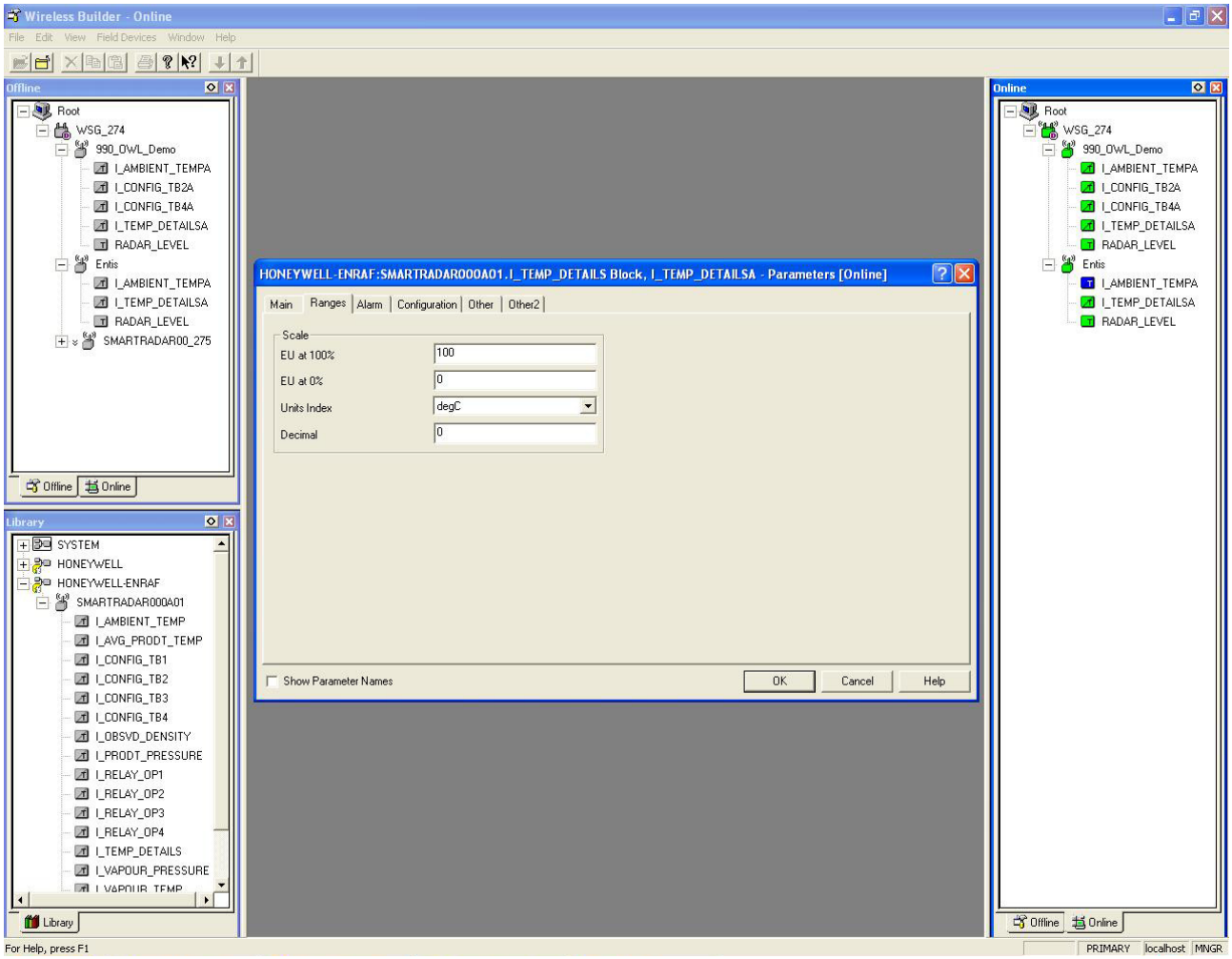



| Parameter | Description |
|---|---|
| Name | Specify the name of the transducer block. |
| Associated Device | Specifies the device that contains the transducer block that you are editing.<br>The device name is set during commissioning with the Wireless Builder and is stored in the TAG descriptor entity. |
| Actual Mode | Specify the actual operation mode of the transducer block. This may differ from the normal mode. For example, if the device is Out of Service. |
| Normal Mode | Specify that this is the mode the transducer block should be in normal situations. |
| Permitted Mode | Specify the permitted modes for the transducer block. |

| Parameter | Description |
|---|---|
| Process Variable | You can manually overwrite the parameter (such as level), if the transducer block is set to manual mode.<br>This is not standard within OneWireless. The manual value entered here is also available in the FlexConn environment. If the Transducer block is not in Manual mode an error code is generated after selecting OK. |

#### *7.4.5.2.4.2 Ranges Tab*

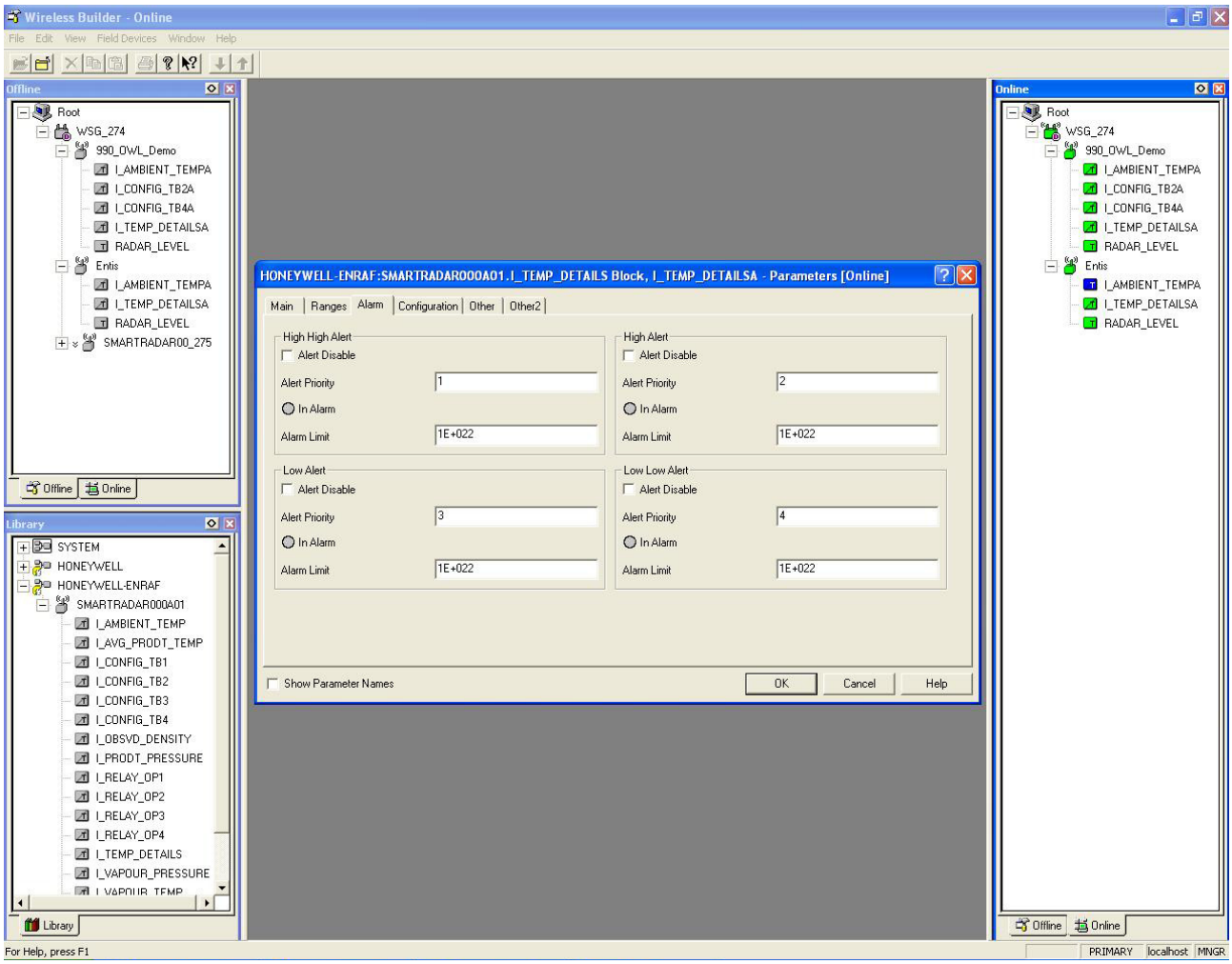
The Ranges tab contains the settings for Engineering units.




| Parameter | Description |
|---|---|
| EU at 100% | Not used in the SmartRadar FlexLine. |
| EU at 0% | Not used in the SmartRadar FlexLine. |
| Units Index | Select the required engineering unit from the list of available units. (Level units for the level TB, and temperature units for the Temperature TB)<br>**Note**: For supported units, see 7.4.5.2.8. |
| Decimal | Not used in the SmartRadar FlexLine. |

#### *7.4.5.2.4.3 Alarm Tab*

The Alarm tab contains the various alarm settings (High high, High, Low, and Low low).




| Parameter | Description |
|---|---|
| Alert Disable | Use this option to disable an alarm. |
| Alert Priority | Use this option to define the alert priority.<br>For more information on alert priority, see the OneWireless Documentation. |
| In Alarm | Specifies the actual alarm status. |
| Alarm Limit | Specify the alarm trip point. |

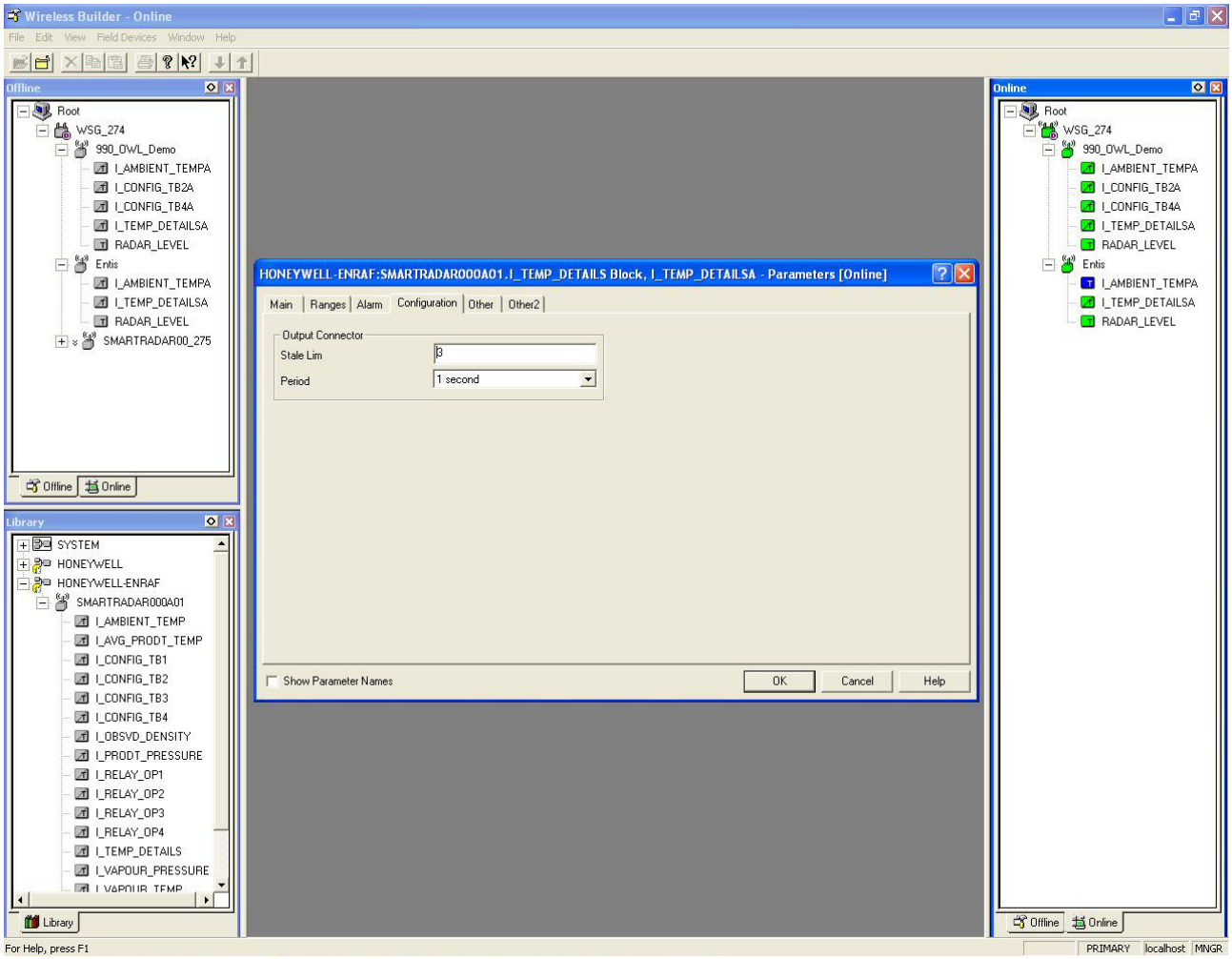
*NOTE: The alarm hysteresis is defined in the "Other" tab.*

*NOTE: Providing alerts on measured variables is not standard in OneWireless. Be careful when you use these alarms as these alarms are also used in*

*Experion. As these alarms are visible as system alarms and NOT as process alarms.*

#### *7.4.5.2.4.4 Configuration Tab*

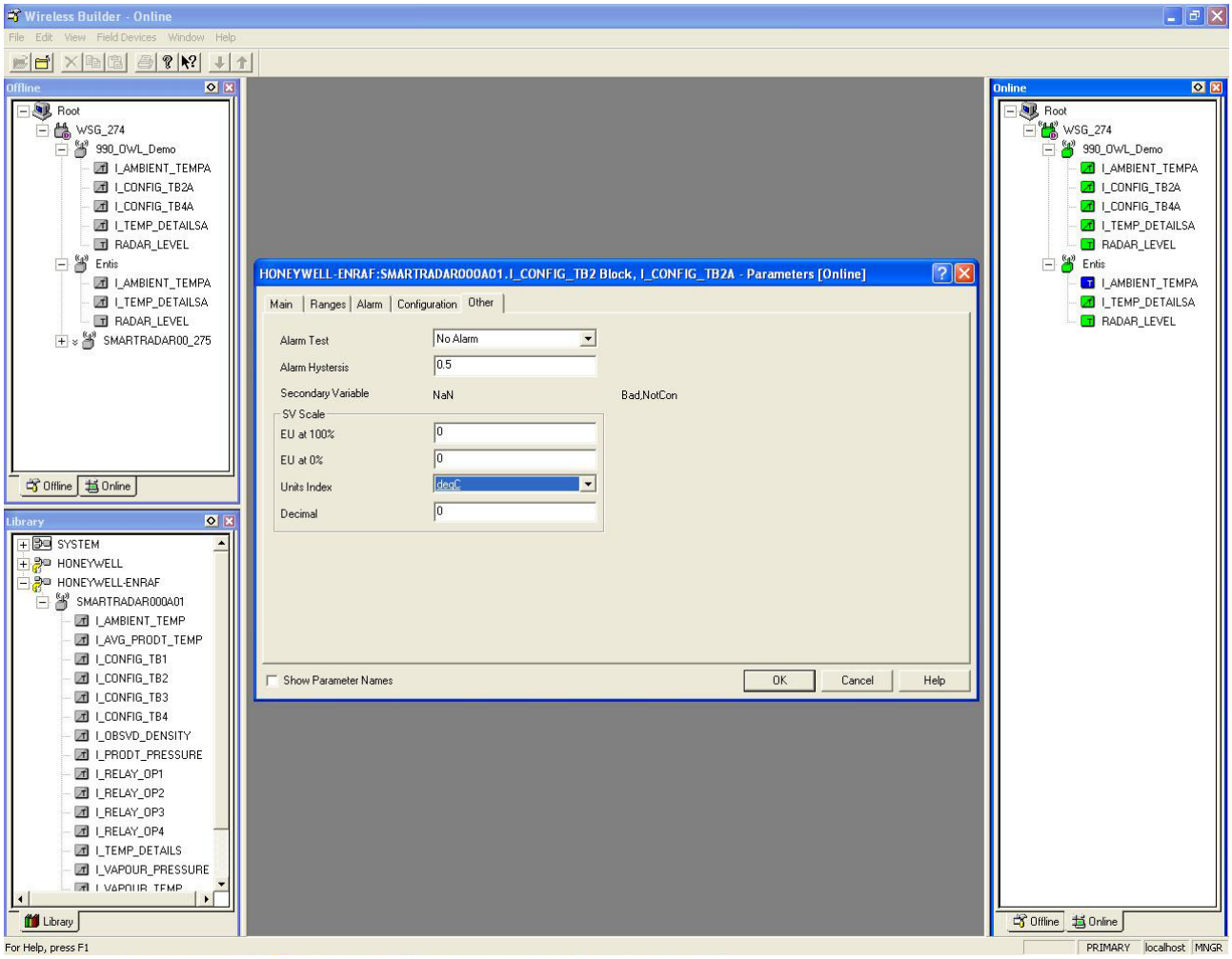
The Configuration tab describes the publication time and time-out settings.




| Parameter | Description |
|---|---|
| Stale Lim | Specify the Publication data stale limit. For more details, see OneWireless documentation. |
| Period | Specify the publication time for the primary variable of this transducer block. The values can be 1, 5, 10, or 30 seconds. For more details, see OneWireless documentation. |

#### *7.4.5.2.4.5 Other Tab (1)*

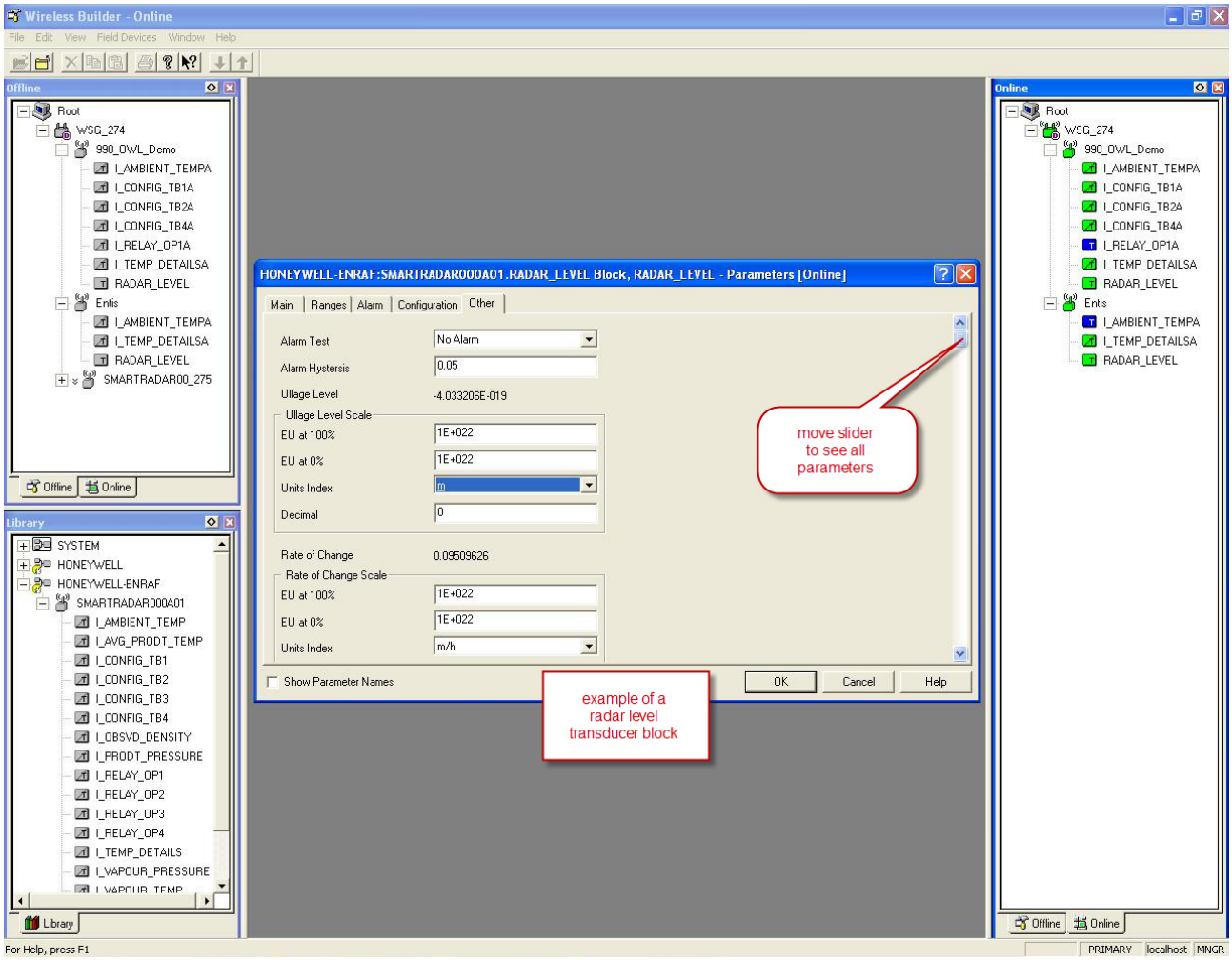
The Other tab is used to initiate an alarm test.




| Parameter | Description |
|---|---|
| Alarm Test | Select an alarm level to test - High high, High, Low, or Low low - and select OK. The SmartRadar performs an Alarm test command.<br>For detail settings, see 7.4.5.2.4.6. |
| Alarm Hysteresis | Specify the alarm hysteresis setting.<br>For detail settings, see 7.4.5.2.4.6. |

#### *7.4.5.2.4.6 Other Tab (2)*

The Other tab details are specified in the figure below.




| Parameter | Description |
|---|---|
| Alarm Test | Select an alarm level to test - High high, High, Low, or Low low - and select OK. The SmartRadar performs an Alarm test command.<br>For detail settings, see 7.4.5.2.4.6. |
| Alarm Hysteresis | Specify the alarm hysteresis setting.<br>For detail settings, see 7.4.5.2.4.6. |
| Ullage Level Scale: | |
| - EU at 100% | Not used in the SmartRadar FlexLine. |
| - EU at 0% | Not used in the SmartRadar FlexLine. |
| - Units Index | Select the required engineering unit from the list of available units. (level units for the level TB, and temperature units for the temperature TB).<br>Note: For supported units, see 7.4.5.2.8. |
| - Decimal | Not used in the SmartRadar FlexLine. |

| Parameter | Description |
|---|---|
| Rate of Change Scale: | |
| - EU at 100% | Not used in the SmartRadar FlexLine. |
| - EU at 0% | Not used in the SmartRadar FlexLine. |
| - Units Index | Select the required engineering unit from the list of available units. (level units for the level TB, and temperature units for the temperature TB).<br>Note: For supported units, see 7.4.5.2.8. |
| - Decimal | Not used in the SmartRadar FlexLine |

#### *7.4.5.2.5 Configurable Transducer Block Settings*

The *configurable* transducer blocks do not represent a fixed input function of the SmartRadar. Configurable transducer blocks can be programmed to represent any available functions on any of the available FlexConn boards in the SmartRadar.

*NOTE: The configuration of the configurable transducer blocks must be done **using Engauge**.*

**Example**

*Configurable Transducer block 1* could be programmed to represent the radar level from the CAN-XBAND. Then the PV of this tranducer block represents the PV of the radar level function, the Innage value. The SV of this transducer block represents the SV of the radar level function, the Ullage level.

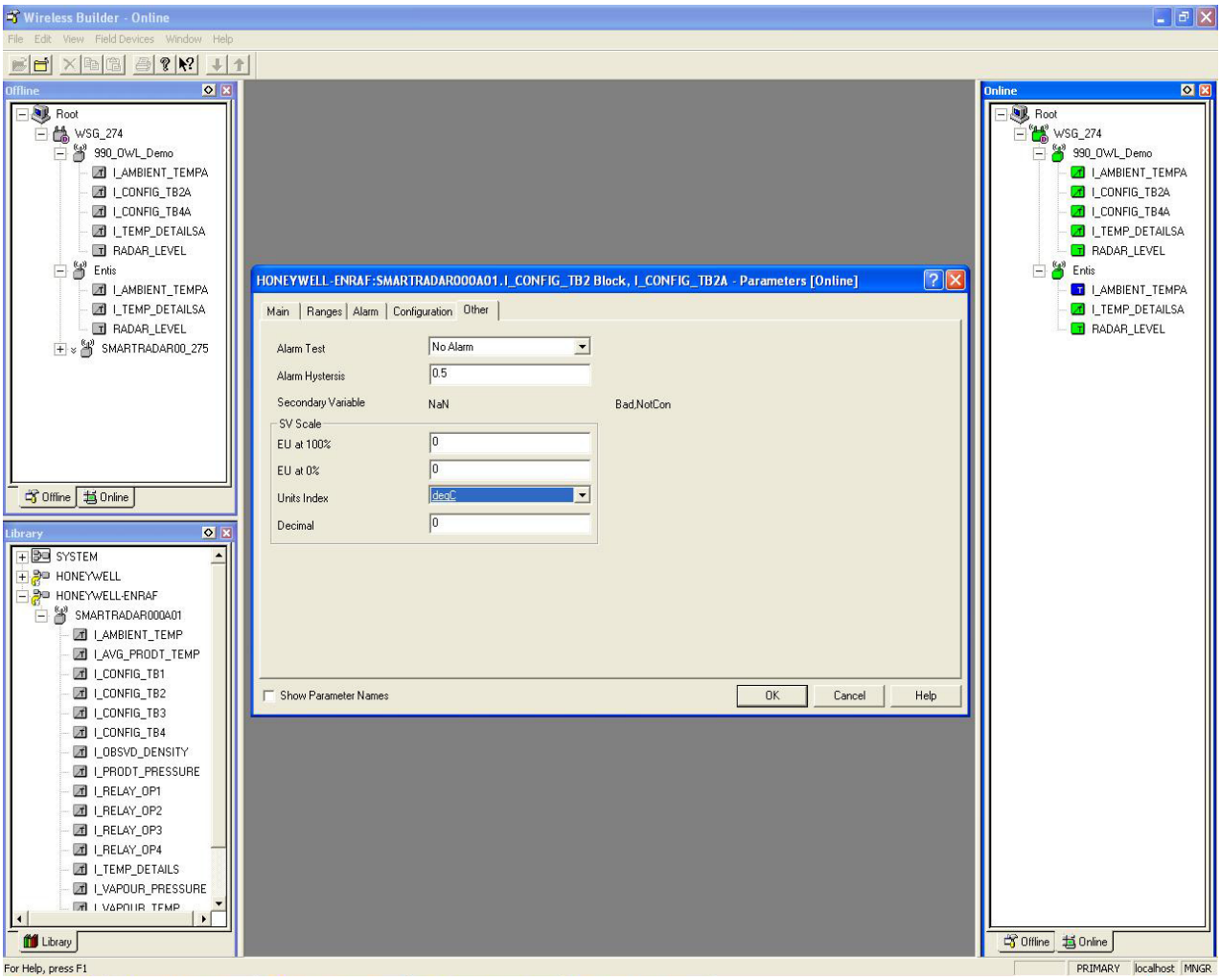
The current firmware version does have *some limitations* on what can be programmed in these transducer blocks.

- Configurable *Transducer block 1* can only represent *Levels*. This is valid for both the PV and the SV.
- Configurable *Transducer block 2* can only represent *Temperatures*. This is valid for both the PV as the SV.
- Configurable *Transducer block 3* can only represent *either pressure or Density*. This is valid for both the PV and the SV.
- Configurable *Transducer block 4* can represent parameters with variable dimensional units. The following parameters are supported: *Level, Temperature, Pressure, Density, Current, or NO UNIT*. This is valid for both the PV and the SV.

In wireless builder these limitations must be taken into account *when changing the units index*, for both the PV as the SV. If you select a dimensional unit that is not supported by the Transducer block then an error message appears.

The *Units Index* for the PV is available on the *Ranges* tab.

The *Units Index* for the SV is availabke on the *Other* tab. This tab has a different layout than in a standard transducer block, and is described below.




| Parameter | Description |
|---|---|
| Alarm Test | Select an alarm level to test - High high, High, Low, or Low low - and select OK. The SmartRadar performs an Alarm test command.<br>For detail settings, see 7.4.5.2.4.6. |
| Alarm Hysteresis | Specify the alarm hysteresis setting.<br>For detail settings, see 7.4.5.2.4.6. |
| Secondary Variable | Specifies the secondary variable of this transducer block. This Secondary Variable equals the Secondary Value (SV) of the assigned FlexConn function. |
| - EU at 100% | Not used in the SmartRadar FlexLine. |
| - EU at 0% | Not used in the SmartRadar FlexLine. |

| Parameter | Description |
|---|---|
| - Units Index | Select the required engineering unit from the list of available units. (level units for the level TB, and temperature units for the temperature TB).<br><br>**Note**: See also limitations described before.<br><br>**Note**: For supported units, see 7.4.5.2.8. |
| - Decimal | Not used in the SmartRadar FlexLine. |

#### *7.4.5.2.6 Temperature Details Transducer Block Settings*

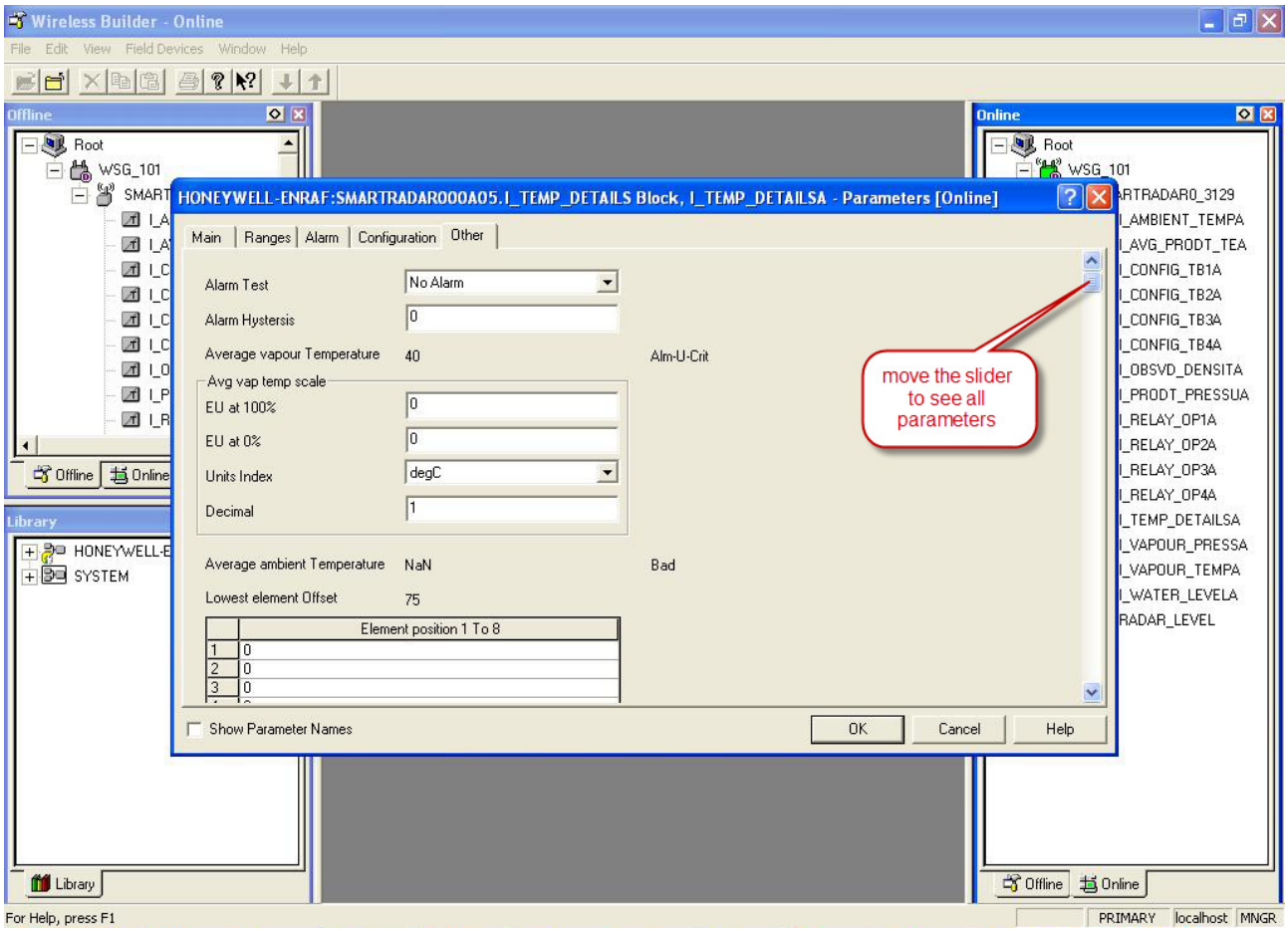
The *Temperature Details transducer block* is an additional temperature transducer block that can be used if details of individual temperature elements (for example, to make a temperature profile) are relevant.

The Average product temperature transducer block publishes the average product temperature as PV and the Vapour Temperature as SV.

The additional parameters can be used through the OneWireless user interface or the OPC server.

*NOTE: This Transducer block is not necessary when making temperature profiles through a tool that uses GPU communication.*

The temperature details can be found on the *Other* tab. This tab has a different layout than it has in a standard transducer block. It is described below.




| Parameter | Description |
|---|---|
| Alarm Test | Select an alarm level to test - High high, High, Low, or Low low - and select OK. The SmartRadar performs an Alarm test command.<br>For detail settings, see 7.4.5.2.4.6. |
| Alarm Hysteresis | Specify the alarm hysteresis setting.<br>For detail settings, see 7.4.5.2.4.6. |
| Average Vapour temperature | Specifies the average Vapour temperature |
| EU at 100% (avg temp scale) | Not used in the SmartRadar FlexLine. |
| EU at 0% | Not used in the SmartRadar FlexLine. |

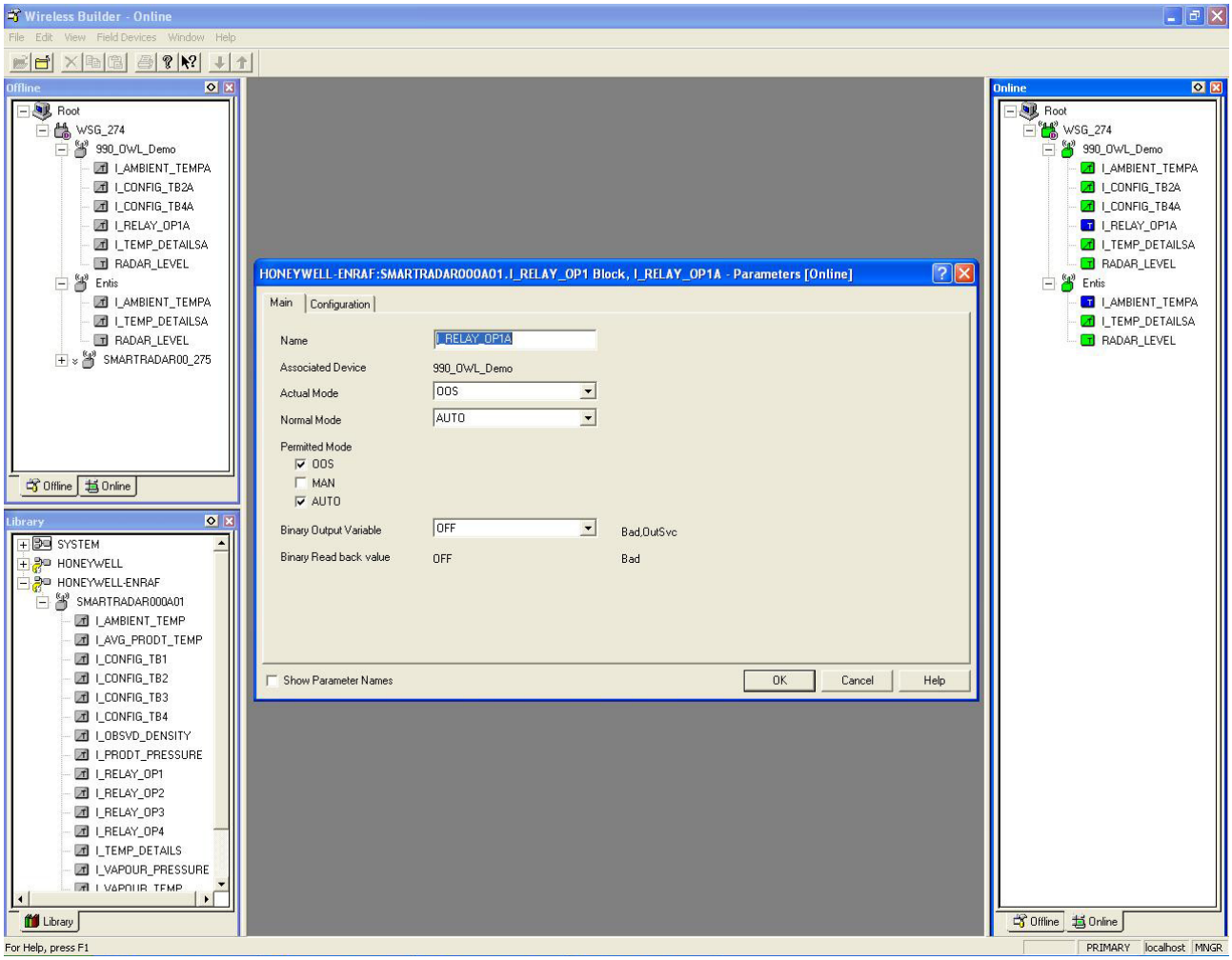
| Parameter | Description |
|---|---|
| Units Index | Select the required engineering unit from the list of available units. (level units for the level TB, and temperature units for the temperature TB).<br><br>**Note**: For supported units, see 7.4.5.2.8. |
| Decimal | Not used in the SmartRadar FlexLine. |
| Average Ambient temperature | Specifies the average ambient temperature. |
| Lowest element offset | Specifies the offset of lowest temperature element relative to the bottom of the tank. |
| Element position 1...8 | Specify the position of the temperature elements 1...8. |
| Element position 9...16 | Specify the position of the temperature elements 9...16 |
| EU at 100% (level scale) | Not used in the SmartRadar FlexLine. |
| EU at 0% | Not used in the SmartRadar FlexLine. |
| Units Index | Select the required engineering unit from the list of available units. (level units for the level TB, and temperature units for the temperature TB).<br><br>**Note**: For supported units, see 7.4.5.2.8. |
| Decimal | Not used in the SmartRadar FlexLine. |
| Element temperature 1...8 | Specify the temperature of element 1...8. |
| Element temperature 9...16 | Specify the temperature of element 9...16. |
| Element temperature status 1...8 | Specify the status of element temperature 1...8. |
| Element temperature status 9...16 | Specify the status of element temperature 9...16. |
| Number of elements | Specifies the number of installed temperature elements. |
| MRT or RTD element type | Specifies the type of installed temperature element.<br><br>TPL = MTT Honeywell Enraf<br>QSA = MRT Sangamo<br>SPL = Spot PT100 Large<br>SPS = Spot PT100 Small<br>SNI = Spot Ni191<br>SSS = Spot Sangamo CU90<br>SCB = Spot Beacon CU90<br>SCN = Spot CU90 Nulectohm |

#### 7.4.5.2.7 *Relay Output Transducer Block Settings*

The *Relay output transducer blocks* are standard *Binary Output* transducer blocks. (In contrast to all other transducer blocks, which are *Analog Input* transducer blocks.)

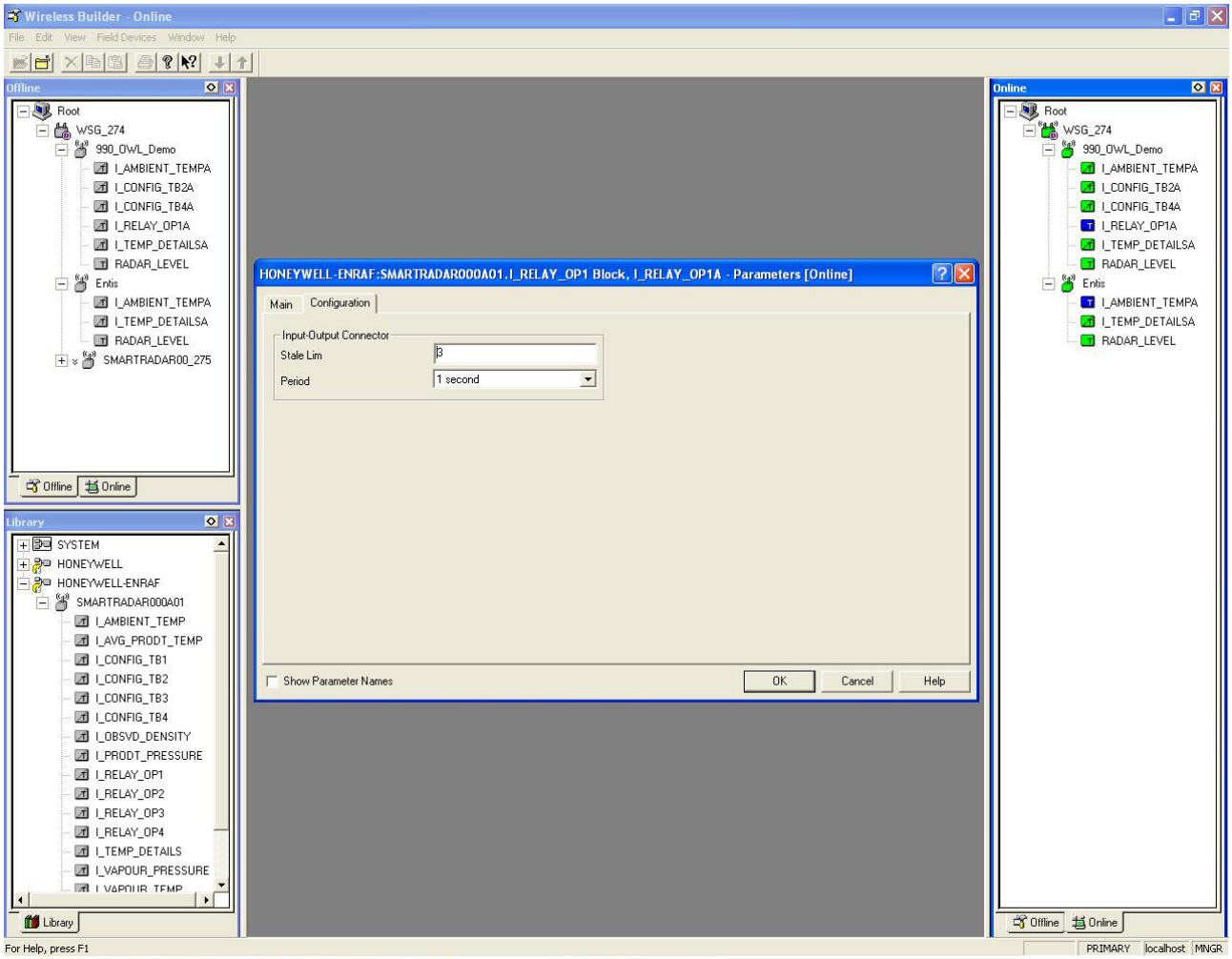
There are 4 relay output blocks, each representing one of the 4 relays that can be installed in the SmartRadar FlexLine. These transducer blocks can be used to remotely control the relays, provided these relays are programmed as remote controllable in Engauge.

For more information about the block, refer to the figure and the table below which describes the important parameters.




| Parameter | Description |
|---|---|
| Name | Specify the name of the transducer block. |

| Parameter | Description |
|---|---|
| Associated Device | Specifies the device that contains the transducer block you are editing.<br>The device name is set during commissioning with Wireless Builder and is stored in the TAG descriptor entity. |
| Actual Mode | Specify the actual operation mode of the transducer block. This may differ from the normal mode, for example if the device is Out of Service. |
| Normal Mode | Specify the mode that the transducer block should be in normal situations. |
| Permitted Mode | Select the permitted modes for the transducer block. |
| Binary Output Variable | Select this option to control the relay. This field has no function if the relay itself is not programmed to be a remote controlled relay. |
| Binary Read back value | Select the read-back value to represent the actual position of the relay. |




| Parameter | Description |
|---|---|
| Stale Lim | Specify the publication data stale limit. For more details, see OneWireless documentation. |

| Parameter | Description |
|---|---|
| Period | Select the publication time to determine the primary variable of this transducer block. This can be 1, 5, 10, or 30 seconds. For more details, see OneWireless documentation. |

#### *7.4.5.2.8 Supported Units*

The SmartRadar FlexLine supports the following units.

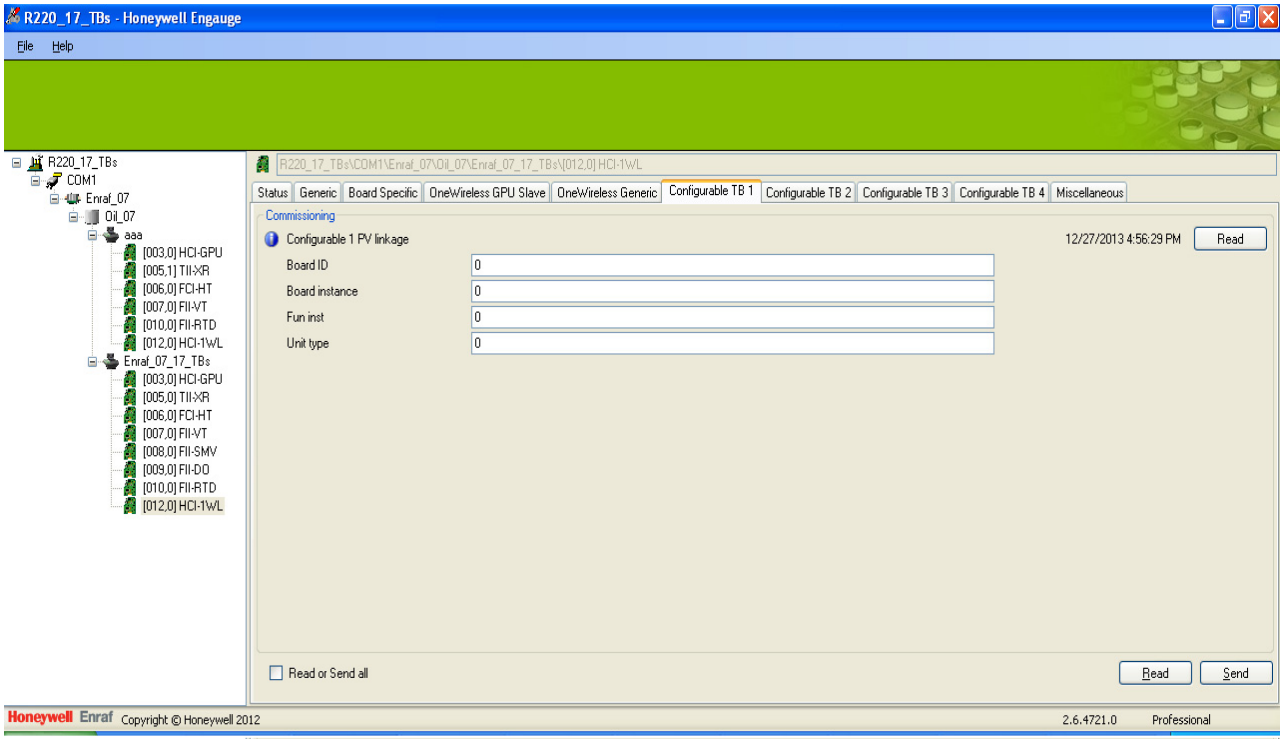
| Parameter | Supported Units |
|---|---|
| Level and position | Meters (m) |
| | Millimeters (mm) |
| | Inches (in) |
| | Feet (ft) |
| Level rate of change | Millimeters / second (mm/s) |
| | Meters / hour (m/h) |
| | Inch / minute (in/min) |
| | Feet / minute (ft / minute) |
| Temperature | Degrees Celsius (ºC) |
| | Degrees Fahrenheit (ºF) |
| Pressure | Pascal (Pa) |
| | kilo Pascal (kPa) |
| | bar |
| | psi |
| Density | kg / $m^3$ |
| | kg / l |
| | g / ml |
| | lbs / $ft^3$ |
| | deg API |

### 7.4.5.3 Commissioning the HCI-1WL Configurable Transducer Blocks

The configuration of the configurable transducer blocks can*not entirely be performed through the Wireless Builder*.

To configure the configurable transducer blocks, the following entities must be set by using *Engauge*.

*NOTE: These settings are only available for Engauge Professional users.*




| Name | Explanation | Value Range | Default |
|---|---|---|---|
| [Board ID] | The board ID of the board that contains the function you want to map to the configurable transducer block. Look in the board list which boards are available. | <0...255> | <0> |
| [Board Instance] | The board instance of the board that contains the function you want to map. This is usually 0. Look in the board list to see if any boards are available more than once in the instrument. | <0...7> | <0> |
| [Function Instance] | This identifies the function which data you want to map to this transducer block. | <0...15> | <0> |
| [Unit Type] | The unit type is necessary to identify in One Wireless. | <0...5> | <0><br>units of data:<br>0 = no unit<br>1 = level<br>2 = temperature<br>3 = pressure<br>4 = density<br>5 = current |

All 4 configurable transducer blocks have the same settings in *Engauge*. However, the various configurable transducer blocks are reserved for particular types of data:

- *Configurable Transducer block 1* is reserved for *level* data.
- *Configurable Transducer block 2* is reserved for *temperature* data.
- *Configurable Transducer block 3* is reserved for *density and pressure* data.
- *Configurable Transducer block 4* can be used for *any* of the data types mentioned above.

The *Secondary Variable* (SV) of the configurable function block is automatically assigned to the *Secondary Value of the FlexConn board function* that is linked to the Primary Variable PV as described before.

**Example**

To link a configurable transducer block to the Radar Level of the TII-XR, the following settings need to be configured:

[Board ID] = 5
[Board instance] = 0
[Function instance] = 1
[Unit type] = 1

## 7.5 The OneWireless Communication Option (HCI-1WL) - Single Slot (for R220)

### 7.5.1 Introduction

The Host Communication Instrument OneWireless (HCI-1WL) board is a communication module for the instrument (gauge).

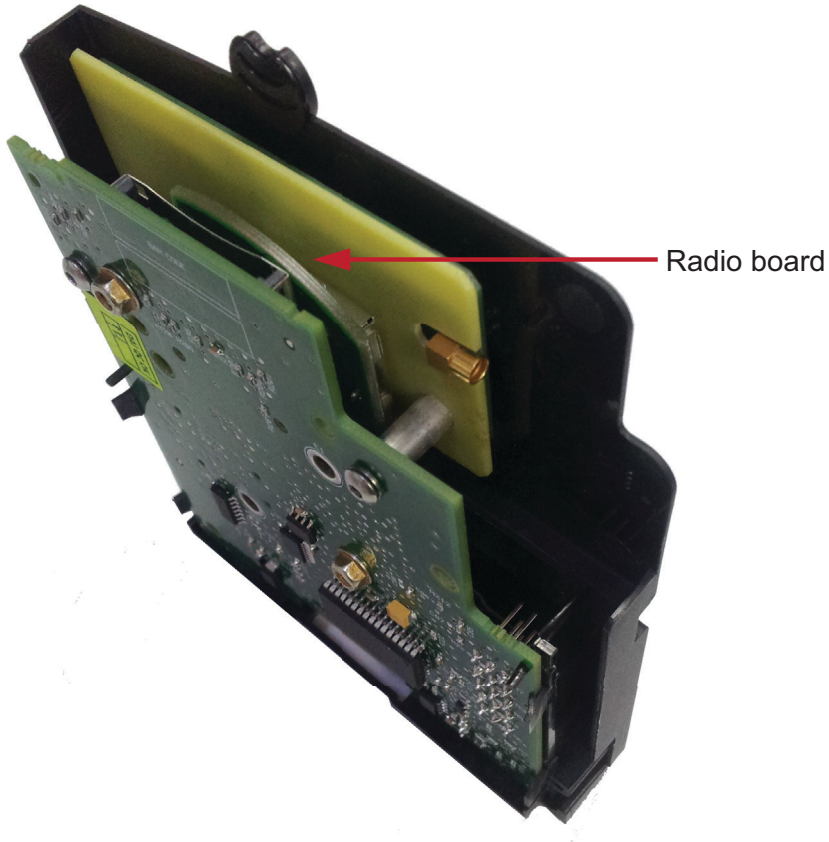



FIGURE 7-6 The HCI-1WL single slot assembly

F4A09-0011

This module consists of (see FIGURE 7-6): a standard FlexConn board with a memory-card interface, and a standard Honeywell OneWireless Radio board.

HCI-1WL module is used to communicate with the gauge. The Radio module board enables wireless communication with the gauge.

If this wireless communication option is installed, the instrument (gauge) can communicate with a host system using the OneWireless network using the following the following ways:

- Directly through the OneWireless Network (using the HCI-1WL board).
- By using a *protocol tunnel* through the OneWireless network:
  - Through the Enraf FlexConn protocol.

- Through the Enraf GPU protocol.

*OneWireless* is an all digital, two-way communication mesh network that interconnects industrial field sensors to a central system.

OneWireless has defined standards to which field devices and operator stations communicate with one another. The communications protocol is built as an "open system" to allow all field devices and equipment that are built to the OneWireless standard to be integrated into a system, regardless of the device manufacturer. This interoperability of devices using OneWireless technology is to become an industry standard for automation systems.

In the OneWireless network, devices like the SmartRadar FlexLine publish their measuring values autonomously at the network. Through an OPC server connected to gateway(s), the data is made available for further use.

The Honeywell Enraf GPU and FlexConn protocols are implemented for communication with Honeywell Enraf Tank Inventory Software systems. For example, Entis Pro, Entis XL, and Entis XS. Additionally, these protocols enable communication with configuration and diagnostic tools such as *Engauge*. These protocols are implemented in the same way as in the HCI-GPU and HCI-BPM. Hence, they only support the same limited set of GPU records and items.

### 7.5.2 Potential Electrostatic Charging Hazard

*WARNING! Do NOT wipe the surface of the antenna with dry cloth, and do NOT clean its surface with a solvent.*

*If electrostatically charged, discharge of the antenna surface to a person or a tool could ignite a surrounding hazardous atmosphere.*

### 7.5.3 Adding a Radar to the OneWireless Network

#### 7.5.3.1 Introduction

Before a radar is visible in the OneWireless network, it must be supplied with a correct network security key, so it is allowed to join the protected wireless network.

You must be properly trained in Honeywell OneWireless solutions before adding the SmartRadar in a OneWireless network. To establish communication with the OneWireless network the SD card, WDM, and the Wireless user interface tools are required. Refer to the respective manuals for details.

*CAUTION! **France** restricts outdoor use to 10mW (10 dBm) EIRP in the frequency range of 2,454-2,483.5 MHz. Installations in France must limit EIRP to 10 dBm for operating modes utilizing frequencies in the range of 2,454 – 2,483.5MHz. For this reason, Honeywell Enraf does not recommend configuring frequency*

*hopping modes that use this frequency range.*

***For installations in France, use only the following OneWireless Frequency Hopping (FH) Mode Selections:*** *EU Channel #1, EU Channel #7, NA/EU Guard Bands and NA/EU Channel 3 (FH Mode selections #4, 5, 8 and 10).*

#### 7.5.3.2 Preparing the Radar

Before adding a radar to a one wireless Network, old security information must be removed from the radar. To prevent this from happening by accident, this functionality is only available through the *SmartView*. To erase the security information:

1. Go to [Menu] > [Commands]
2. Enter the password
3. Go to the HCI-1WL
4. Select [Board] and issue the [Restore Default] command.

#### 7.5.3.3 Authentication

1. Ensure the OneWireless Network is operational and at least 1 multi-node configured as gateway.
2. Provision a SmartRadar FlexLine field device using the SD card to authenticate the keys from the WDM.
3. Insert the SD card into the memory card slot of the HCI-1WL device.
4. Make sure to close the device if it is installed in an explosion hazardous area.
5. Switch on the device

The device is now automatically join the OneWireless network.

You can follow the authentication/joining process by navigating to the correct page on the *SmartView*, see 7.5.7.1. Or by using *Engauge*, see 7.5.8.1, if there is also a wired connection available.

If the message [NOREDUN] or [CONNECT] does NOT become visible, the authentication failed.

☛ If authentication failed, verify that the wireless network is operating correctly, and try again with a new security key.

### 7.5.4 Removing a Radar From the OneWireless Network

To remove a radar from a OneWireless Network, the security key information must be removed from the radar. To prevent this from happening by accident, this functionality is only available through the *SmartView*.

To erase the security key information:

☛ Go to [Menu] > [Commands]

☛ Enter the password

☛ Go to the HCI-1WL

☛ Select [Board] and issue the [Restore Default] command.

### 7.5.5 Commissioning the HCI-1WL in the OneWireless Network for R220

#### 7.5.5.1 Introduction

When the authentication process is completed, the SmartRadar can be commissioned in the OneWireless network.

Before you continue with this step, ***familiarize yourself with the OneWireless user interface*** for the OneWireless network. For a detailed operation guide for the OneWireless user interfece, refer to the ***OneWireless Wireless Device Manager User's Guide, R220 or later***.

With the OneWireless user interface you can create, delete, commission, load, and unload the SmartRadar just like any other OneWireless devices. You can also activate and inactivate transducer blocks, and program the different parameters, such as publication period, as with any other devices.

Once the Authentication process has been successfully completed, the SmartRadar automatically is listed in the *left pane* of the OneWireless user interface as an *uncommissioned device*.

Follow the procedures mentioned in the *OneWireless Wireless Device Manager User's Guide* to commission the devices.

By default, the SmartRadar contains *transducer block: Radar Level*.

During further commissioning, more transducer blocks can be added.

#### 7.5.5.2 Transducer Blocks for R220

##### *7.5.5.2.1 Introduction*

Besides the Radar Level transducer block, up to 16 additional transducer blocks can be added to the device using the OneWireless user interface.

The specific parameters for all the available transducer blocks can be set using the OneWireless user interface.

Refer to the *Configuring SmartRadar FlexLine field device channels* section for more information regarding the configuration of the field device channels.

This section explains about the additional or non-standard transducer block items. Additionally, it also describes the procedures to configure the transducer blocks (channels).

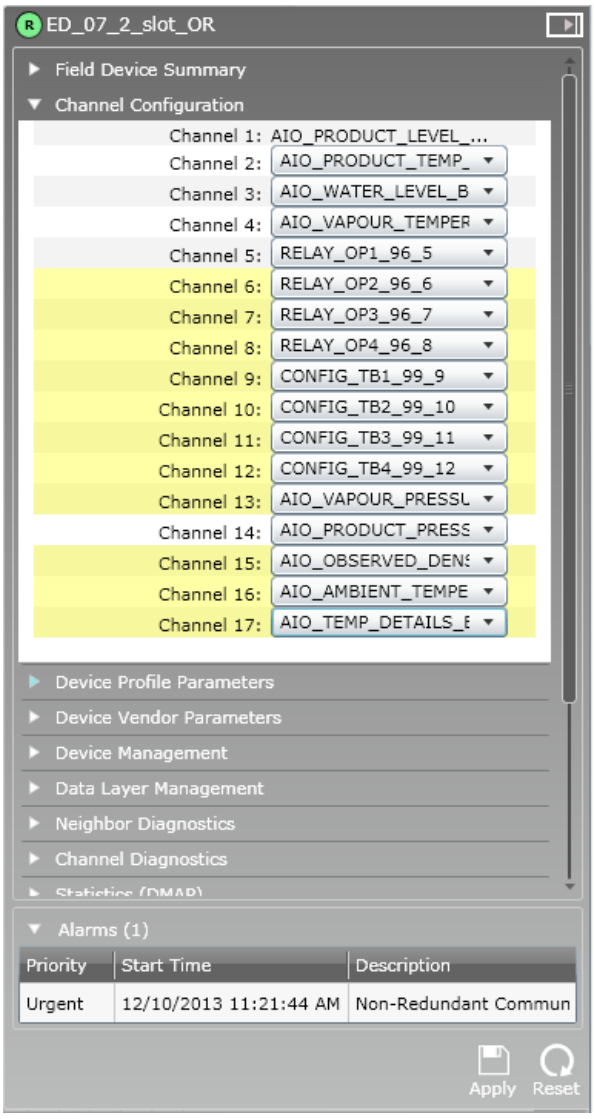
*NOTE: Each transducer block can only be added to the SmartRadar FlexLine field device once. Only 8 transducer blocks (including one Level transducer block) can be configured at a time.*

##### *7.5.5.2.2 Adding Transducer Blocks*

To configure a channel, you must first add the transducer blocks to this field device.

### To add a transducer block

1. On the **Selection Panel**, select the field device.
2. Expand **Channel Configuration** and click the respective instantiable object type for the channel to be instantiated.




3. Click **Apply**.

### To add channel to publication group

1. On the **Property Panel**, expand **Input Publication** panel.
2. In the **Channel** drop-down list, click the channel for which data publication needs to be enabled.
3. Click **Apply**.

### To activate the channel

1. On the **Selection Panel**, select the field device channel.
2. Do one of the following:
   - On the ribbon bar, in the **Channel** group, click **Activate**.
   - On the **Property Panel**, expand **Mode** and then in the **Target** list, click **Auto**.
3. Click **Apply**.

   The channel icon appears as green indicating active mode.

*NOTE: Only 2 channels can be instantiated at one time. On instantiating more than 2 channels may lead to an error.*

The following additional transducer blocks are available.

| Channel | Transducer Block | Board | See Section |
|---|---|---|---|
| Channel 1 | Product Level | TII-XR | 7.5.5.2.5 |
| Channel 2 | Average Product temperature | FII-VT & FII-RTD | 7.5.5.2.6 |
| Channel 3 | Water Level | FII-VT | 7.5.5.2.7 |
| Channel 4 | Vapour Temperature | FII-VT & FII-RTD | 7.5.5.2.8 |
| Channel 5 | Relay output 1 | FII-DO | 7.5.5.2.10 |
| Channel 6 | Relay output 2 | FII-DO | |
| Channel 7 | Relay output 3 | FII-DO | |
| Channel 8 | Relay output 4 | FII-DO | |
| Channel 9 | Configurable Transducer block 1 | | 7.5.5.2.9 |
| Channel 10 | Configurable Transducer block 2 | | |
| Channel 11 | Configurable Transducer block 3 | | |
| Channel 12 | Configurable Transducer block 4 | | |
| Channel 13 | Vapour Pressure | FII-HT | 7.5.5.2.11 |
| Channel 14 | Product Pressure | FII-HT | 7.5.5.2.12 |
| Channel 15 | Observed Density | FII-HT | 7.5.5.2.13 |
| Channel 16 | Ambient Temperature | FII-RTD | 7.5.5.2.14 |
| Channel 17 | Temperature details | FII-RTD | 7.5.5.2.15 |

All the transducer blocks can be loaded to any SmartRadar FlexLine field device. However, a transducer block provides only valid data when a relevant option is installed in the SmartRadar FlexLine field device.

For example, for a temperature transducer blocks to become available, an FII-RTD or FII-VT must be installed in the SmartRadar FlexLine field device, and for the Relay output transducer blocks to work accurately, an FII-DO must be installed.

#### *7.5.5.2.3 General Transducer Block Settings*

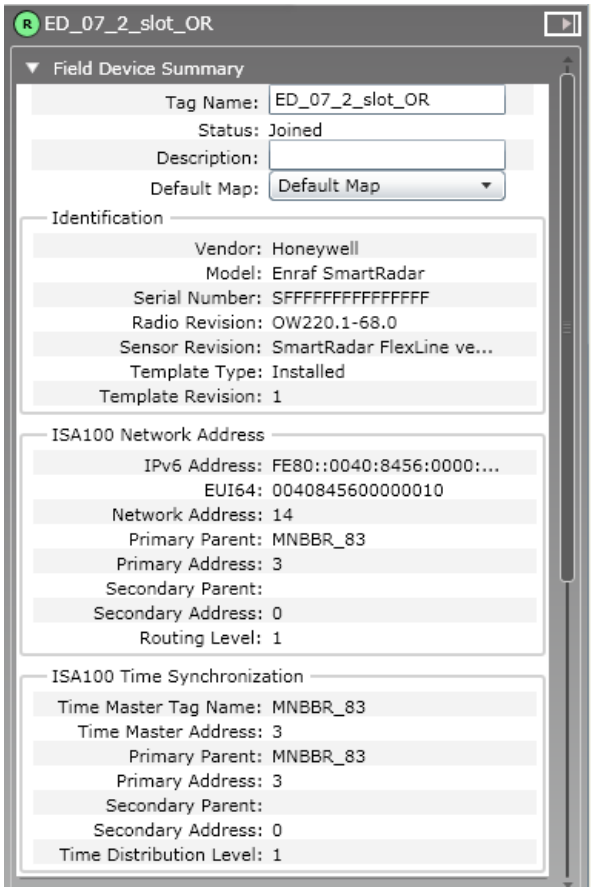
To view general transducer block settings, on the **Property Panel**, expand **Channel Configuration** which displays a list of instantiated channels.

#### 7.5.5.2.4 OneWireless User Interface

##### 7.5.5.2.4.1 Configure field device properties

The **Field Device Summary** displays the general details of the field device.

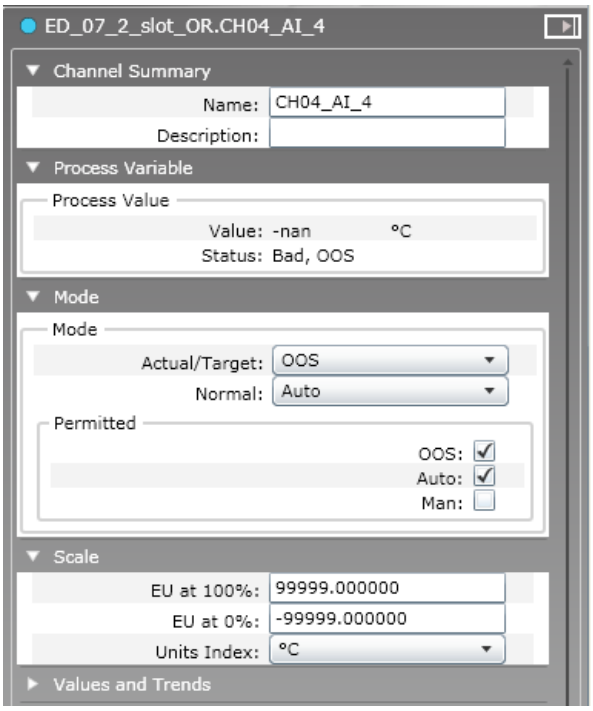
For more information regarding the details to configure the tag name and description, refer to the "Click Reset Statistics to reset all the ENRAF interface statistics." section.




##### 7.5.5.2.4.2 Configure Mode and Scale

Configure the Mode and Scale entities for the SmartRadar FlexLine field device channel.

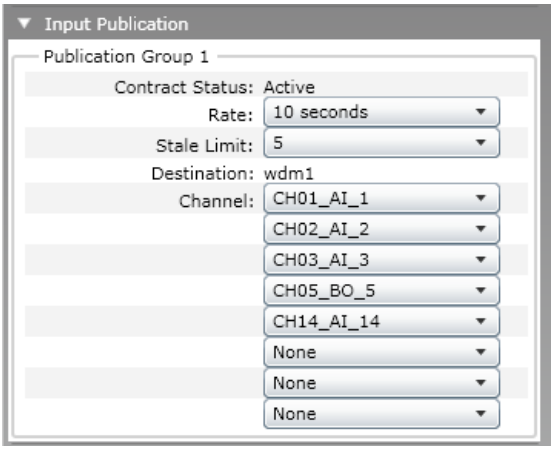
For more information regarding the configuration of the mode and scale entities, refer to the "Configure Mode and Scale" section.

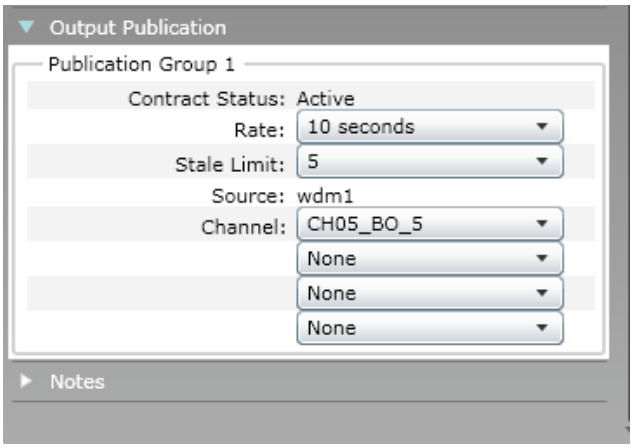



#### *7.5.5.2.4.3 Configure publication rate*

The publication data for input and output field devices can be configured using the Input Publication panel in the Property Panel. Depending on the device type, a field device can have an **Input Publication** panel. This is determined by the DD file for the field device.

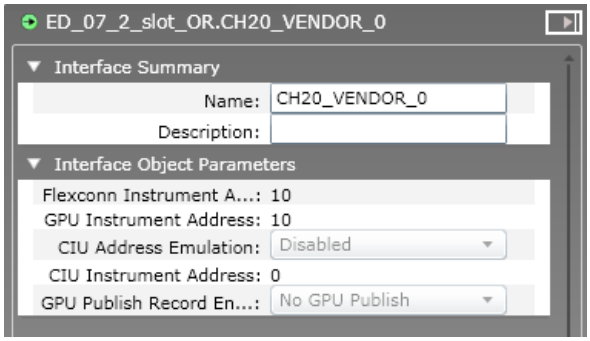
For more information regarding the configuration of the Input publication and Output publication entities, refer to the "Configure publication rate" section.



#### 7.5.5.2.4.4 *Configure SmartRadar FlexLine field device interface*

To configure Interface Summary and Interface Object Parameters, refer to the section "Configuring SmartRadar FlexLine field device".




#### 7.5.5.2.5 *Product Level Transducer Block settings*

*Product level transducer blocks* can be used to publish product level data measurements from the TII-XR boards. Product level data is used to calculate the volume of the product contained in the tank.

The product level transducer block publishes product levels as PV and ullage product level as SV.

#### 7.5.5.2.6 *Average Product Temperature Transducer Block settings*

Average product temperature Transducer Blocks can be used to publish product temperature values measured using either FII-VT or FII-RTD boards.

The average product temperature transducer block publishes average product temperature as PV.

#### 7.5.5.2.7 *Water level transducer block settings*

*Water level transducer blocks* can be used to publish water level data measurements from FII-VT board.

The water level transducer block publishes water levels as PV and ullage level as SV.

#### 7.5.5.2.8 *Vapour Temperature Transducer Block settings*

*Vapour temperature transducer blocks* can be used to publish average vapour temperature values measured using FII-HT board.

The vapour temperature transducer blocks publishes average vapour temperature as PV.

#### 7.5.5.2.9 *Configurable Transducer Block Settings*

The *configurable* transducer blocks do not represent a fixed input function of the SmartRadar. Configurable transducer blocks can be programmed to represent any available functions on any of the available FlexConn boards in the SmartRadar.

*NOTE: The configuration of the configurable transducer blocks must be performed using Engauge.*

**Example**

*Configurable Transducer block 1* is programmed to represent the radar level from the CAN-XBAND. Then the PV of this tranducer block represents the PV of the radar level function, the Innage value. The SV of this transducer block represents the SV of the radar level function, the Ullage level.

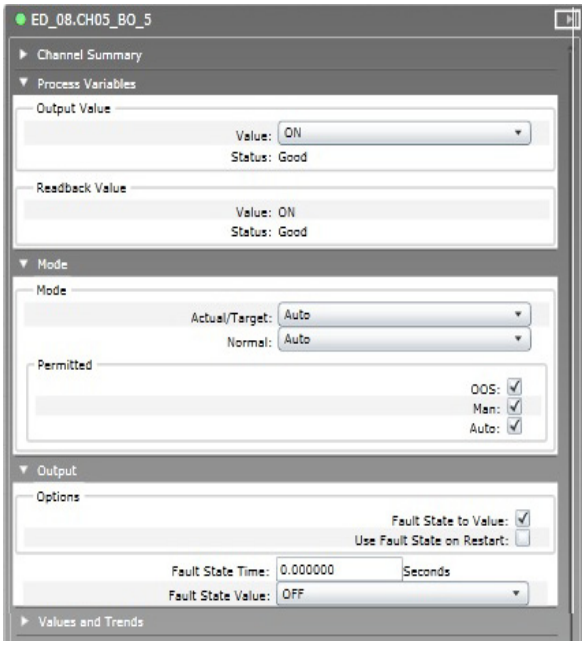
- Configurable *Transducer blocks 1 to 4* can represent parameters with variable dimensional units. The following parameters are supported: *Level (TII-XR), Temperature (FII-VT and FII-RTD), Pressure (FII-HT), Density (FII-HT), or NO UNIT*. This is valid for both the PV and the SV.

#### *7.5.5.2.10 Relay Output Transducer Block Settings*

The *Relay output transducer blocks* are standard *Binary Output* transducer blocks. (In contrast to all other transducer blocks, which are *Analog Input* transducer blocks.)

There are 4 relay output blocks, each representing one of the 4 relays that can be installed in the SmartRadar FlexLine. These transducer blocks can be used to remotely control the relays, provided these relays are programmed as remote controllable in Engauge.

For more information about the block, refer to the figure and the table below which describes the important parameters.



| Parameter | Description |
|---|---|
| Actual/Target | Specifies the actual operation mode of the transducer block. This may differ from the normal mode, for example if the device is Out of Service. |
| Normal | Specifies the mode the transducer block should be in normal situations. |
| Permitted Mode | Specifies the permitted modes for the transducer block which can be selected. |
| Output Variable | Specifies the value to control the relay. This field has no function if the relay itself is not programmed to be a remote controlled relay. |
| Readback Value | Specifies the read-back value that represents the actual position of the relay. |

#### *7.5.5.2.11 Vapour Pressure Transducer Block Settings*

*Vapour Pressure transducer blocks* can be used to publish average vapour pressure values measured using the FII-HT board.

The vapour pressure transducer block publishes vapour pressure as PV.

Additionally, the pressure type (absolute or relative) is also published.

*NOTE: While using the Engauge tool, vapour pressure is displayed under the 'P3 Pressure' sub tab.*

#### *7.5.5.2.12 Product Pressure Transducer Block Settings*

*Product pressure transducer blocks* can be used to publish standard product pressures values measured using the FII-HT board.

The product pressure transducer block publishes product pressure as PV and secondary pressure as SV.

Additionally, the pressure type (absolute or relative) is also published.

*NOTE: While using the Engauge tool, product pressure is displayed under the 'P1 Pressure' sub tab, and the secondary pressure is displayed under the 'Pressure' sub tab.*

#### *7.5.5.2.13 Observed Density Transducer Block Settings*

*Observed density transducer blocks* can be used to publish observed density values measured using the FII-HT boards.

The observed density transducer block publishes observed density as PV and product temperature as SV.

*NOTE: While using the Engauge tool, observed density is displayed under the 'HIMS Density' sub tab.*

#### *7.5.5.2.14 Ambient Temperature Transducer Block Settings*

*Ambient temperature transducer blocks* can be used to publish ambient temperature values measured from FII-RTD boards.

The ambient temperature transducer block publishes ambient temperature as PV.

#### *7.5.5.2.15 Temperature Details Transducer Block Settings*

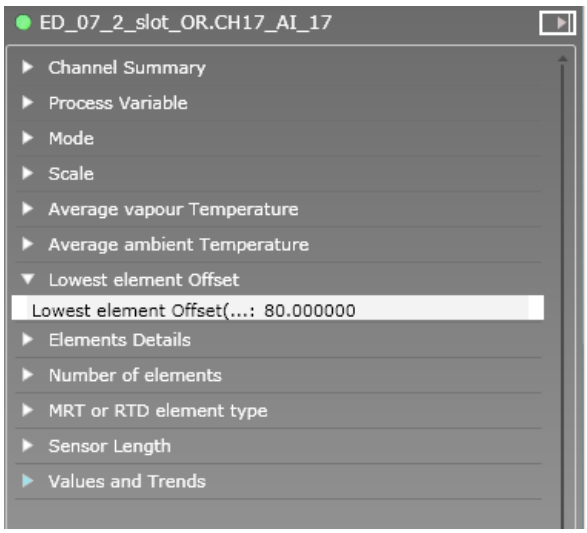
The *Temperature Details transducer block* is an additional temperature transducer block that can be used if details of individual temperature elements (for example, to make a temperature profile) are relevant.

The Average product temperature transducer block publishes the average product temperature as PV and the Vapour Temperature as SV.

The additional parameters can be used through the OneWireless user interface or the OPC server.

*NOTE: This Transducer block is not necessary when you create temperature profiles through a tool that uses GPU communication.*

For more information about the block, refer to the figure and the table below which describes the important parameters.




| Parameter | Description |
|---|---|
| Average Vapour Temperature | Specifies the average Vapour temperature. |
| Average Ambient temperature | Specifies the average ambient temperature |
| Lowest element Offset | Specifies the offset of the lowest temperature element relative to the bottom of the tank. |
| Number of elements | Specifies number of installed temperature elements. |

| Parameter | Description |
|---|---|
| MRT or RTD element type | Specifies the type of installed temperature element.<br><br>TPL = MTT Honeywell Enraf<br>QSA = MRT Sangamo<br>SPL = Spot PT100 Large<br>SPS = Spot PT100 Small<br>SNI = Spot Ni191<br>SSS = Spot Sangamo CU90<br>SCB = Spot Beacon CU90<br>SCN = Spot CU90 Nulectohm |

#### *7.5.5.2.16 Supported Units*

The SmartRadar FlexLine supports the following units.

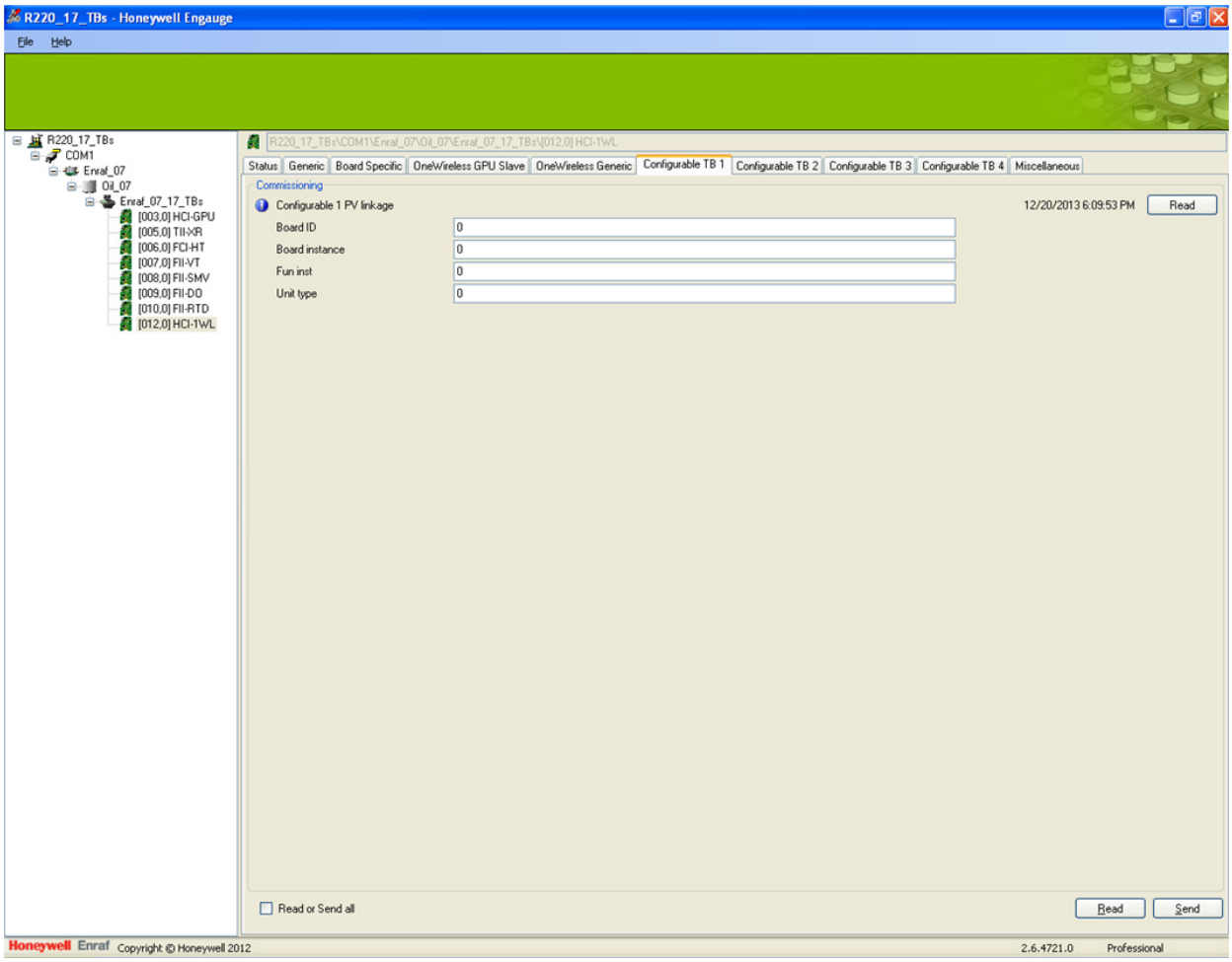
| Parameter | Supported Units |
|---|---|
| Level and position | Meters (m) |
| | Millimeters (mm) |
| | Inches (in) |
| | Feet (ft) |
| Level rate of change | Millimeters / second (mm/s) |
| | Meters / hour (m/h) |
| | Inch / minute (in/min) |
| | Feet / minute (ft / minute) |
| Temperature | Degrees Celsius (ºC) |
| | Degrees Fahrenheit (ºF) |
| Pressure | Pascal (Pa) |
| | kilo Pascal (kPa) |
| | bar |
| | psi |
| Density | kg / $m^3$ |
| | kg / l |
| | g / ml |
| | lbs / $ft^3$ |
| | deg API |

### 7.5.5.3 Commissioning the HCI-1WL Configurable Transducer Blocks

The configuration of the configurable transducer blocks can*not entirely be performed through the OneWireless user interface*.

To configure the configurable transducer blocks, the following entities must be set by using *Engauge*.

*NOTE: These settings are only available for Engauge Professional users.*




| Name | Explanation | Value Range | Default |
|---|---|---|---|
| [Board ID] | Specifies the board ID for the board that contains the function that you want to map to the configurable transducer block.<br><br>Check the board list which boards are available. | <0...255> | <0> |

| Name | Explanation | Value Range | Default |
|---|---|---|---|
| [Board instance] | Specifies the board instance for the board that contains the function you want to map. The defualt value is 0.<br>Look in the board list to see if any boards are available more than once in the instrument. | <0...7> | <0> |
| [Function inst] | Specifies which data you want to map to this transducer block. | <0...15> | <0> |
| [Unit type] | Specifies the necessary unit type in One Wireless. | <0...5> | <0><br>units of data:<br>0 = no unit<br>1 = level<br>2 = temperature<br>3 = pressure<br>4 = density<br>5 = current |

All 4 configurable transducer blocks have the same settings in Engauge. Configurable Transducer block 1 through 4 can be used for level, temperature, density and pressure.

The *Secondary Variable* (SV) of the configurable function block is automatically assigned to the *Secondary Value of the FlexConn board function* that is linked to the Primary Variable PV as described before.

**Example**

To link a configurable transducer block to the Radar Level of the TII-XR, the following settings need to be configured:

[Board ID] = 5
[Board instance] = 0
[Function instance] = 1
[Unit type] = 1

### 7.5.6 Commissioning the HCI-1WL for GPU and FlexConn Communication

By using a *protocol tunnel* through the OneWireless network, it is possible to connect the standard Honeywell Enraf Entis systems, or service tools.

The physical connection between the Entis systems or service tools is either through an *Ethernet* connection to the Gateway, or through an

*RS-232* line through a *Lantronix RS-to-Ethernet convertor* to the Gateway. See chapter 4.2.1 for details.

For the correct functioning of the HCI-GPU module in an instrument (gauge), the following entities ***can*** be set by using either *Engauge* or *SmartView*.

*Engauge*
*SmartView*

☛By using the following table, check each entity for correctness.

| Name | Value Range | Default Value | Explanation |
|---|---|---|---|
| [Identification] | 8 characters e.g. <TANK1234> | <--------> | Name of a tank or instrument |
| [GPU instrument address] | <0..99> | <0> | The address of this instrument for GPU messages. Note: Each instrument must have a unique GPU address. |
| [GPU Caching] | <caching off> <GPU B record> <GPU C record> <GPU D record> <GPU L record> <GPU M record> | <caching off> | By switching on caching, the system performance can be greatly improved. Switching caching on for a record means that the OneWireless network will automatically keep an up-to-date copy of this record in the internal cache of the gateway. This copy will be refreshed each second. Any request for this record will NOT be sent to the instrument but *directly be answered from the cache*.<br><br>Note: Do not use this setting for W&M approved systems. |
| [FlexConn instrument address] | <0..1899> | <0> | The address of this instrument for FlexConn messages. Note: Each instrument must have a unique FlexConn address. |
| [Level units] | <meters> <inches> <feet> <fractions> | <meters> | The unit in which level-related GPU records and items are shown |
| [Temperature units] | <celsius> <fahrenheit> | <celsius> | The unit in which temperature-related GPU records and items are shown |

| Name | Value Range | Default Value | Explanation |
|---|---|---|---|
| [Pressure units] | <pascal><br><kilo pascal><br><psi small> (2 digits before separator)<br><psi large> (3 digits before separator) | <pascal> | The unit in which pressure-related GPU records and items are shown |
| [Density units] | <kilogram m3><br><degrees API><br><pounds ft3> | <kilogram m3> | The unit in which density-related GPU records and items are shown |
| [Decimal separator] | <point><br><comma> | <point> | The decimal separator in which GPU-related records and items are shown |
| [Level type] | <innage><br><ullage> | <innage> | The level-related GPU records and items can be shown as an innage or ullage.<br>Note:<br>• *Innage* is the level of the product measured from the bottom.<br>• *Ullage* is the level of free space from the roof till the product. |
| [Password] | <.....> 6 characters | <ENRAF2> | Password for entering the protected level.<br>Note: Some settings reside under the protected level. |
| [Function identification] | <.....> 13 characters | <GPU-slave> | The name of the current function of this module. This name is visible on the *SmartView* display. |

☛After having checked/set all before listed entities, make sure

- the [Board Commissioned] and the [OneWireless GPU slave Commissioned] entities are <True>;

the [Board Health] and the [OneWireless GPU slave Health] entities are <GOOD>.

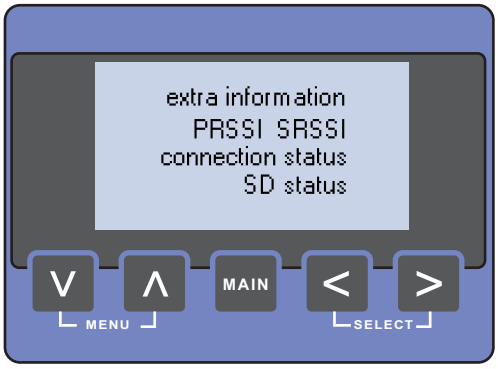
### 7.5.7 Using the SmartView with the OneWireless Communication Option

#### 7.5.7.1 Introduction

The *SmartView* replaces the display that is usually available on OneWireless transmitters.

#### 7.5.7.2 SmartView OneWireless Status Display

At the *Smartview*, there is a special OneWireless status display available, called the [extra information] display. See screen below.




| Parameter | Description |
|---|---|
| PRSSI | Primary RSSI = Signal strength indicator for primary wireless connection |
| SRSSI | Secondary RSSI = Signal strength indicator for the redundant wireless connection |
| Connection status | Radio connection status |
| SD Status | SD-memory card status |

This screen is required during commissioning for the authentication process and to check the wireless connection quality. It can also be used in case of wireless connection problems.

☛ At the Smartview, enter the menu by pressing Λ + V simultaneously.

☛ Scroll to the menu item [extra information], and press < + > simultaneously, to enter the OneWireless screen.

*NOTE: Since this [extra information] screen is also used for other purposes, it may be possible that you have to configure the 990 SmartRadar to show this screen when the [extra information] menu item is selected. This can be done on the SmartView itself or by using Engauge, see 7.8.2.*

- Signal strength (RSSI = Radio Signal Strength Indicator)

The signal strength is shown in dBm. Below -80 to -85 dBm no reliable connection is possible.

When there is no redundant wireless connection the secondary RSSI does not show a relevant value.

- Connection status

In the display of the Smartview the following Connection status messages can / is visible:

| Display Text | Description |
|---|---|
| NO KEY: | No security key information available<br>Insert a memory card with security information. |
| MACCONN | Intermediate message during connection process |
| SECCONN | |
| CONNECT | The device is connected to the OneWireless network via 2 multinodes / gateways. |
| DISCOVR | Intermediate message during connection process |
| NOTCONN | The radio is not connected.<br>Make sure the OneWireless network is operational.<br>Could also happen if the radar is moved to another network. |
| SECURNG | Intermediate message during connection process |
| NOREDUN | The device is connected to the OneWireless network via 1 multinode / gateway only. |
| BAD KEY | No valid key available.<br>Could happen if the radar is moved to another network (e.g. from factory to customer/ from workshop to real-life network etcetera). |

- SD Status

In the display of the SmartView one out of the following SD card statuses is visible:

| Display Text | Description |
|---|---|
| SDOK | SD card with security key present |
| NOSD | No security key / No SD card / Bad SD card |

### 7.5.8 Radio Board Diagnostic Information and Commands

#### 7.5.8.1 Introduction

Diagnostic information, such as the data in the [extra information] screen, and more, can also be read using *Engauge* (professional version), or with the [Commissioning] screen of the *SmartView*.

Additionally, there are 3 commands that can be given to the radio board on the HCI-1WL module.

### 7.5.8.2 Commands

☛ Select [Read device information], to read the *static* information from the radio board.

After executing this command, the static information from the radio board is read from the radio board and made available in diagnostic entities. See 7.5.8.3.

☛ Select [Read dynamic info], to read the *dynamic* information from the radio board.

After executing this command, the dynamic information from the radio board is read from the radio board and made available in diagnostic entities. See 7.5.8.3.

☛ Select [Restore Defaults], *to remove the security key information* from the radar.

In this way, the radar is disconnect from the wireless network.

*NOTE: This command CANNOT be given via Engauge.*

*CAUTION! With this command all settings on the radio board will be erased!*

### 7.5.8.3 Diagnostic Information

- SD Card Status

| Display Text | Description |
|---|---|
| SDOK | SD card with security key present |
| NOSD | No security key / No SD card / Bad SD card |

- Connection Status

| Display Text | Description |
|---|---|
| NO KEY: | No security key information available<br>Insert a memory card with security information. |
| MACCONN | Intermediate message during connection process |
| SECCONN | |
| CONNECT | The device is connected to the OneWireless network via 2 multinodes / gateways. |
| DISCOVR | Intermediate message during connection process |
| NOTCONN | The radio is not connected.<br>Make sure the OneWireless network is operational.<br>Could also happen if the radar is moved to another network. |
| SECURNG | Intermediate message during connection process |

| Display Text | Description |
|---|---|
| NOREDUN | The device is connected to the OneWireless network via 1 multinode / gateway only. |
| BAD KEY | No valid key available.<br>Could happen if the radar is moved to another network (e.g. from factory to customer/ from workshop to real-life network etcetera). |

- Radio Signal Status

| Parameter | Description |
|---|---|
| TX power level | Transmission power level<br>Note: This is an Advanced Setting! Please read section 7.5.9 before changing this setting. |
| PRSSI | Primary RSSI = Signal strength indicator for primary wireless connection |
| SRSSI | Secondary RSSI = Signal strength indicator for the redundant wireless connection |

- Additional Items

| Parameter | Description |
|---|---|
| Radio diagnostic | No explanation.<br>These diagnostic information items are only relevant if requested by the factory. |
| Radio software build number | |
| Radio Network address | |
| Radio communication channel | |
| Wireless Network ID | |
| Radio mode | |
| Radio IEEE Address | |

### 7.5.9 Advanced Settings - Transmission Power Level

Professional installers are allowed to change to power settings in situations that an *external antenna* is used to compensate for long external cables.

CAUTION

*CAUTION! It is NOT allowed to set the transmission power to a higher level than is allowed by the local authorities. When a radar with an integrated antenna is ordered, the value is set to the correct value in the factory.*

CAUTION

*CAUTION! Only when an external antenna is used, it is allowed to change this setting and only according to the table below.*

- For transmission power-level settings, see table below.

| Area | Antenna Type | Integrated | Remote Cable lenght 1 m | Remote Cable length 3 m | Remote Cable length 10 m |
|---|---|---|---|---|---|
| | | Maximum transmission power level setting | | | |
| Europe | 4 dBi | 9 | 10 | 10 | 12 |
| | 8 dBi | 4 | 5 | 6 | 7 |
| | 14 dBi | Not possible | 1 | 1 | 2 |
| USA and Canada | All types | 20 | | | |

CAUTION

*CAUTION! For the remote antenna cables **only the cables provided by Honeywell Enraf** are approved for use. The use of any other cables or cable lengths are NOT allowed by the Radio approvals.*

- The values in the above tables have been determined through agency certification testing.
- The above output-power levels include the loss from the Lightning Arrestor (0.5dBm).

CAUTION

*CAUTION! Lightning arrestor must be in place for all installations.*

- The following shall apply for antenna type, frequency range, application/usage, and agency/country compliance:
  - Antennas with a higher gain as shown above shall not be used.
  - Maximum overall radio output power shall not exceed 10 mW EIRP (Europe) respectively 100 mW EIRP (USA and Canada) over the full band.
- Industry Canada Compliance Statement:
  - This device has been designed to operate with the antenna types listed in this document, and having a maximum gain of 14 dBi. Antenna types not included in this list or having a gain greater than 14 dBi are strictly prohibited for use with this device. The required antenna impedance is 50 ohms.
  - This device complies with Part 15 of the FCC rules **and RSS-210 of IC**.

### 7.5.10 Firmware Upgrade for R120

You can upgrade the radio firmware through OneWireless *Wireless Builder*.

For more details see the Wireless Builder manual in the chapter *"Upgrading Firmware in commissioned device"*.

*NOTE: Only the **radio firmware** can be upgraded through Wireless Builder. Firmware upgrade of the HCI-1WL board and the other FlexConn boards is performed through the normal FlexConn upgrade procedures.*

### 7.5.11 Firmware Upgrade for R220

#### 7.5.11.1 Upgrading the SmartRadar FlexLine device firmware using Wireless Device Manager

The devices at the farthest hop level must be upgraded first.

**Sensor firmare**

To upgrade the SmartRadar FlexLine sensor firmware, refer to section "Upgrading CAN-1WL FlexConn board of SmartRadar FlexLine gauge" in the *SmartRadar FlexLine Migration User's Guide*.

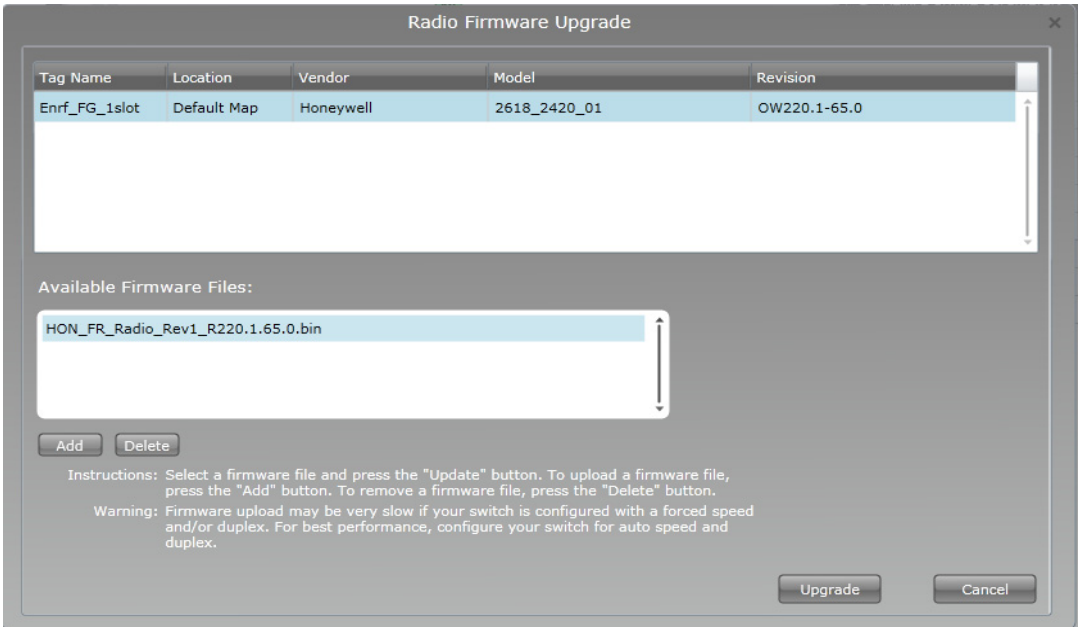
**Radio firmware**

1. On the Selection Panel of the OneWireless user interface, select the field device.

   You can select multiple devices of the same type using the Selection Panel or the map view. Use SHIFT +click to select multiple items in a successive list. Use CTRL+click to select multiple items not in succession.

2. On the ribbon bar, in the **Upgrade** group, click **Radio**.

The **Radio Firmware Upgrade** dialog box appears.


Radio Firmware Upgrade
Tag Name
Location
Vendor
Model
Revision
Enrf_FG_1slot
Default Map
Honeywell
2618_2420_01
OW220.1-65.0
Available Firmware Files:
HON_FR_Radio_Rev1_R220.1.65.0.bin
Add
Delete
Instructions: Select a firmware file and press the "Update" button. To upload a firmware file, press the "Add" button. To remove a firmware file, press the "Delete" button.
Warning: Firmware upload may be very slow if your switch is configured with a forced speed and/or duplex. For best performance, configure your switch for auto speed and duplex.
Upgrade
Cancel

3. In the **Available Firmware Files** list, select the required firmware upgrade files.

   By default, the firmware upgrade file appears in the list. If the file is not available in the list, perform the following steps to open the firmware file.

   a) Click **Add** to browse to the directory location of the firmware upgrade file.

   b) Click **Open**.

4. Click **Upgrade**.

The **Radio Firmware Upgrade** dialog box appears.

The **Firmware Upgrade Status** dialog box ddisplaying the status of the upgrade appears. Closing the dialog box allows the upgrade operation to run in the background. The upgrade status is displayed in the status bar. Click the firmware upgrade status box to open the dialog box again. If multiple users are simultaneously upgrading different device firmware, all the users can view the progress of all the device upgrades.

5. Close the **Firmware Upgrade Status** dialog box.
6. Verify the upgraded version of the firmware is as follows:

a) On the Selection Panel of the OneWireless user interface, select the field device.
b) On the Property Panel, expand **Device Manager Summary**.
c) Under **Identification** group, review the firmware version displayed in the **Sensor Revision** field.

#### 7.5.11.2 Upgrading the SmartRadar FlexLine firmware using the Engauge service tool

The Engauge service tool is used for upgrading the SmartRadar FlexLine field device firmware. For more information regarding the Engauge service tool, refer to the *Service Manual SmartRadar FelxLine*.

Perform one of the following methods to upgrade the firmware based on the boards which need to be upgraded:

1. The sensor boards (TII-XR, FCI-HT, FII-VT, FII-SMV, FII-RTD, HCI-GPU, HCI-BPM, and FII-DO) can be upgraded through the Engauge tool using the protocol tunnel.
2. HCI-1WL (CAN-1WL) board can also be upgraded through the OneWireless user interface through the Application Firmware Upgrade.

*WARNING! The HCI-1WL (CAN-1WL) board should not be upgraded using the Engauge tool. This results in the SmartRadar FlexLine field device dropping from the network permanently and it also damages the card.*

**Considerations**

Following are some of the considerations for upgrading the device firmware.

- You can upgrade only the application firmware or radio firmware of a device at a time.
- You can upgrade only the firmware of three devices simultaneously from the OneWireless user interface.
- Starting the radio firmware upgrade operation of lower hop and upper hop devices simultaneously, results in the failure of upgrade operation of the lower hop device. When the devices are in different hops, it is recommended to perform the upgrade of only one device at a time.
- Upgrading the radio firmware of a device, which routes communication between other devices, results in communication failure.

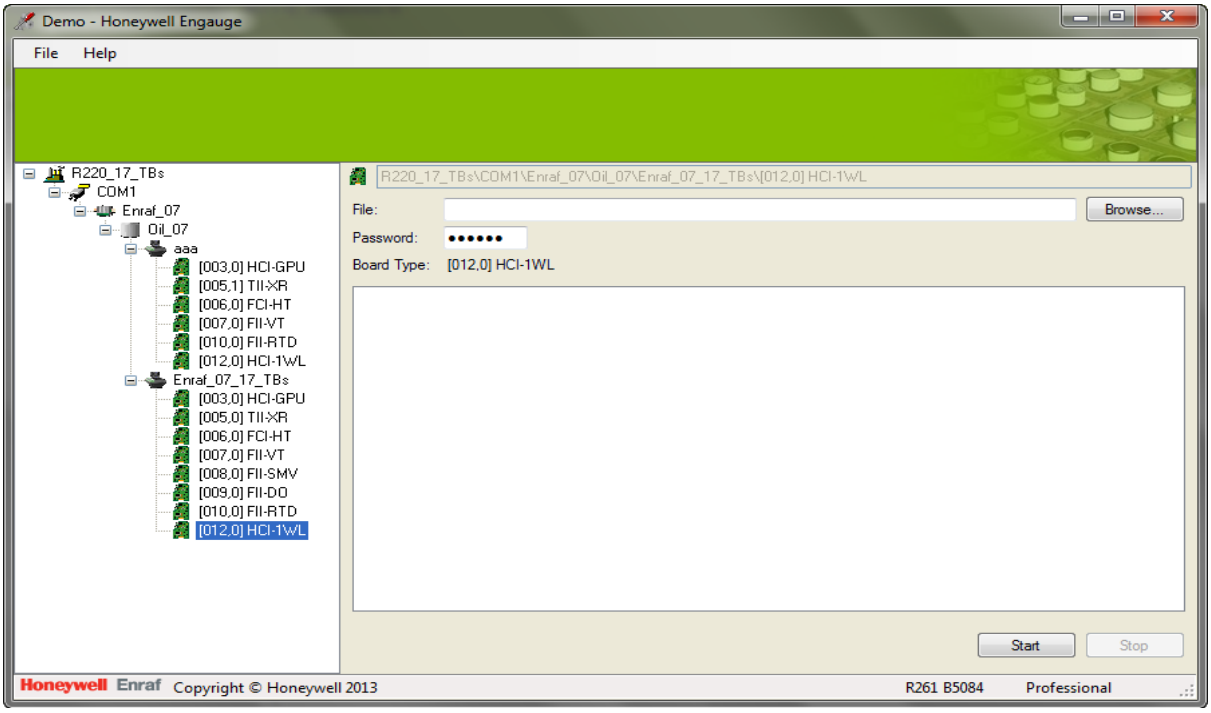
**To upgrade the SmartRadar FlexLine firmware for the cards using Engauge service tool**

1. Double-click the module icon's in the Engauge's explorer, to select each FlexConn module.

   The board descriptor is then loaded with the tab pages. Select the tab pages, to enter the settings of the specific module.

2. On the Engauge service tool explorer, select the required FlexConn module on the left panel.
3. Right-click the FlexConn module and choose **Firmware Update...**

   The **FlexConn Firmware Update — Engauge** dialog box appears.




4. Depending on the firmware type, the available upgrade files appear by default. Select the required file from the list of upgrade files.

   If the file is not available in the list, perform the following steps.

   a) Click **Browse** to browse to the directory location of the firmware upgrade file.

   b) Click **Open**.
5. Click **Start**.

   The upgrade status is displayed in the status bar.
6. Close the **FlexConn Firmware Update — Engauge** dialog box.
7. Enter the **Time Out** value in the Engauge tool as 9999 ms.

## 7.6 Product Level Measurement (TII-XR)

### 7.6.1 Introduction

The Transducer Interface Instrument - X-Band Radar (TII-XR) - is the heart of Enraf's precision X-band (10 GHz) radar system.

It uses the Frequency Modulated Continuous Wave (FMCW) and synthesized pulse reflection principle. Using Enhanced Performance Signal processing (EPS), a smart level detection is possible by filtering out known obstacles.

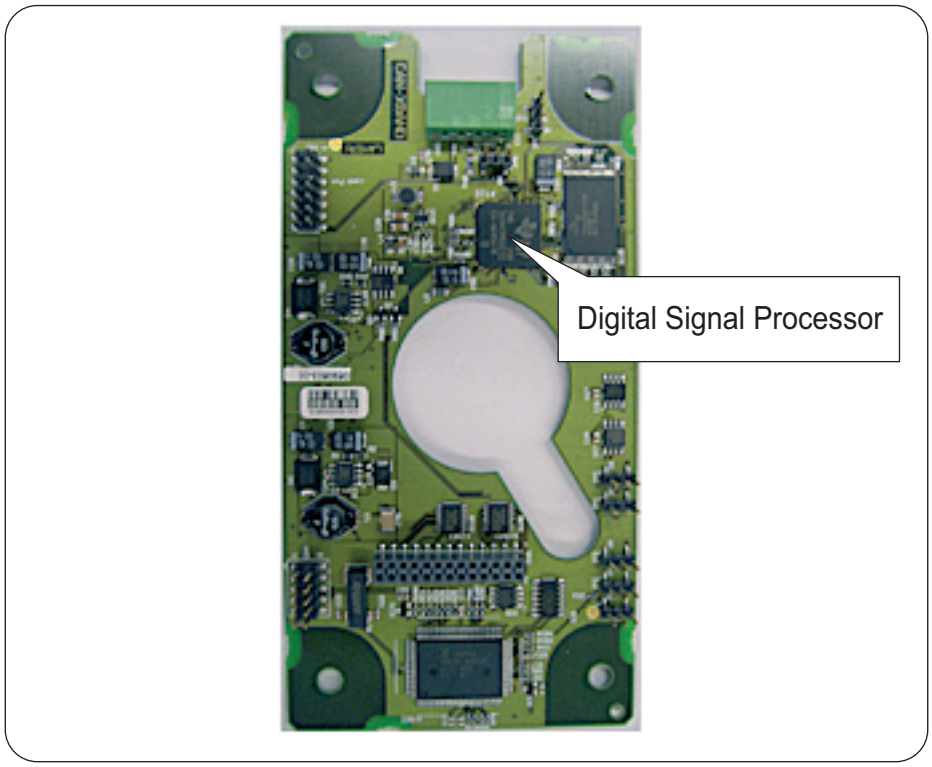



FIGURE 7-7 The TII-XR board with its Digital Signal Processor F4A07-0007

Housed within an explosion-proof, RF-shielded compartment - which also contains a number of other FlexLine modules - and together with a planar radar antenna, it forms the SmartRadar FlexLine system.

### 7.6.2 Basic Commissioning

#### 7.6.2.1 General

In general the user is interested in the tank's product *volume*. To calculate this volume, the primary input is the product *level* within the tank. This level is measured by the radar.

For correct measuring results, a number of parameters such as [Tank bottom position], [Upper reference position], and [Offset to roof] must be defined before.

In addition, alarm settings and compensation (filtering) constants are to be set.

This can be done by using either *Engauge* or *SmartView*.

#### 7.6.2.2 Level Start-Up

For entity definitions, see FIGURE 7-8 and FIGURE 7-9.

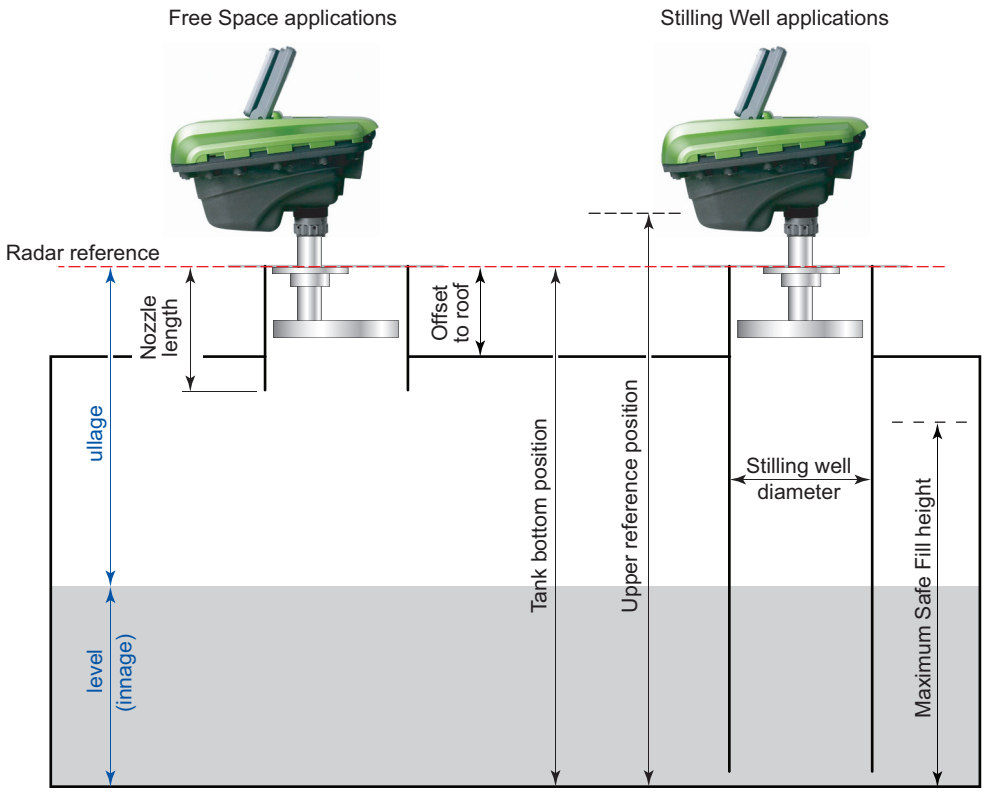



FIGURE 7-8 Basic commissioning entities

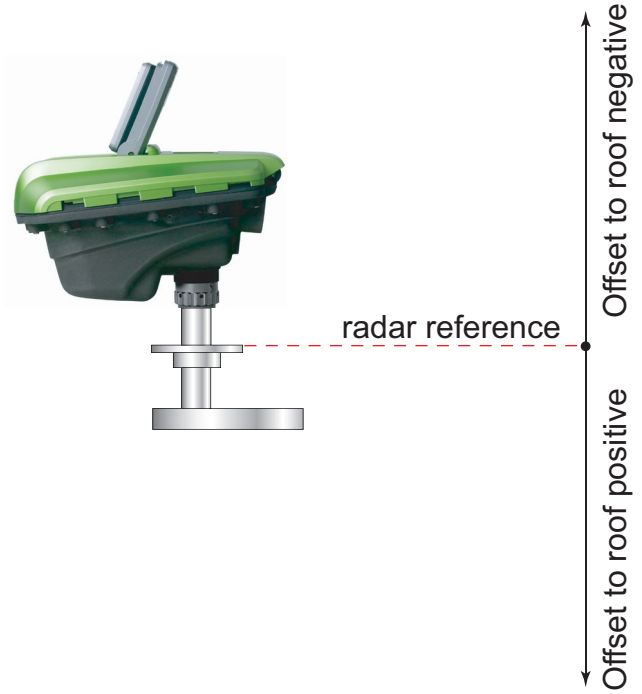



FIGURE 7-9 Definition of [Offset to roof] F4A07-0011

Engauge
SmartView

☛To get the radar gauge level without any compensations enabled (but with averaging filter and maximum Safe fill warnings enabled), program the entities listed in the tables below.

☛For a *Free space* application, program following entities:

| Entity Name | Explanation |
|---|---|
| [Tank bottom position] | The gauge uses this information to calculate the level (innage), and to determine the position of the bottom reflection (part of peak selection). |
| [Maximum Safe fill] | With this entity the gauge checks if the programmed upper measuring range is valid ([Minimum measurable distance] at least <0.5 m> from the antenna). |
| [Upper reference position] | This entity is only used if “ullage” is to be read from the SmartRadar FlexLine. The ullage is then calculated from the measured level (innage) as [Upper reference position]-measured level. |
| [Offset to roof] | The distance between radar reference and the tank roof. The gauge uses this information to determine the position of the echoes caused by the product and the roof. A positive value means the roof is below radar reference (see also FIGURE 7-9). |

| Entity Name | Explanation |
|---|---|
| [Nozzle length] | Needs only to be set if the antenna is installed inside the nozzle. |

☛For a *Stilling well* application, program following entities:

| Entity Name | Explanation |
|---|---|
| [Tank bottom position] | The gauge uses this information to calculate the level (innage), and to determine the position of the bottom reflection (part of peak selection). |
| [Maximum Safe fill] | With this entity the gauge checks if the programmed upper measuring range is valid ([Minimum measurable distance] at least <0.5 m> from the antenna). |
| [Upper reference position] | This entity is only used if “ullage” is to be read from the SmartRadar FlexLine. The ullage is then calculated from the measured level (innage) as [Upper reference position]-measured level. |
| [Stilling well diameter] | The inner diameter of the stilling well |

#### 7.6.2.3 Level Check

With the [Accept reference] command, the gauge’s innage or ullage value is initialized in accordance with the before programmed reference data. From here the gauge will follow all relative level changes.

This command will only be accepted if the product level is <GOOD>.

This command also puts the SmartRadar FlexLine in accurate level measurement mode, so this command MUST be given!

The [Accept reference] command can handle either a reference *innage* or a reference *ullage* level. To adjust to an innage level fill in entity [Reference innage], to adjust to an ullage level fill in entity [Reference ullage]. This level value is mostly obtained by a manual level measurement (hand dip); see FIGURE 7-10.

When all values are sent to the SmartRadar FlexLine, the [Accept reference] command can be given.

When an innage or ullage reference value is not available, the [Accept reference] command must be given without filling any of these entities. The SmartRadar FlexLine will now be put into accurate level measurement mode.

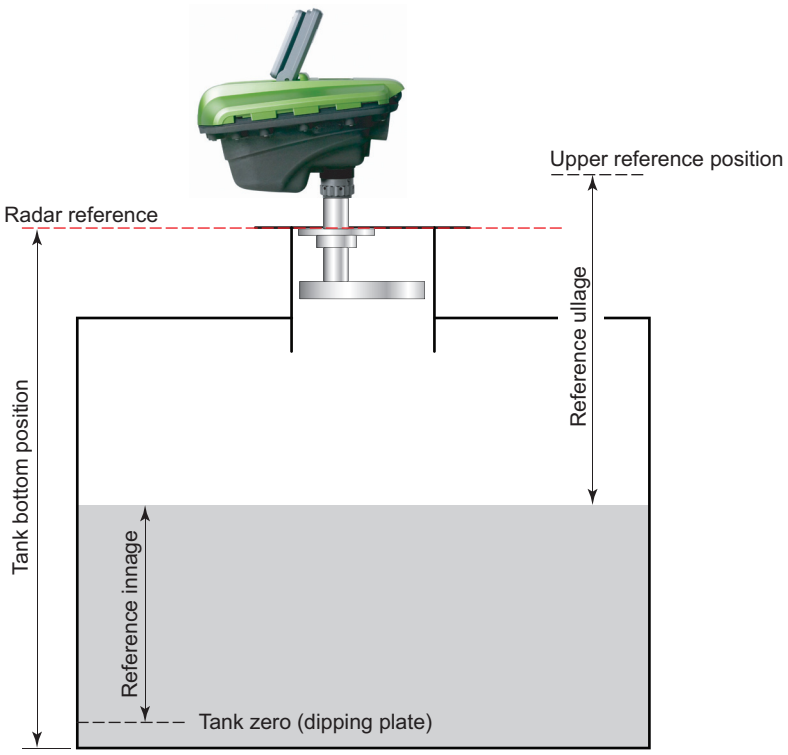



FIGURE 7-10 Level check entities F4A07-0009

*NOTE: This command does not adjust the [Tank bottom position], so this entity should be set manually to approximately the correct value (within ± 0.1 m).*

*Engauge*
*SmartView*

☛ Give the [Accept reference] command.

☛ Make sure the [Accept reference status] is <GOOD>.

Some remarks for the *Engauge* users:

- To make sure the [Accept reference] command works fine, all entities must have been sent to the gauge (no yellow backgrounds may be visible) prior to giving the command.

☛ To read the [Accept reference status], push the [Read] button (is *not* automatically displayed).

Some remarks for the *SmartView* users:

- On the *SmartView* display, the advanced entity [Reference radar] is visible as well. The value of this entity must be left to the default value <+999.9999>.

☛ Check [Reference status] in the commissioning menu, to see if the command has been accepted.

### 7.6.2.4 Alarm Settings

Engauge
SmartView

☛Set the entities [High high alarm], [High alarm], [Low alarm], [Low low alarm], and [Alarm hysteresis] to the desired values.

For definitions, see FIGURE 7-11

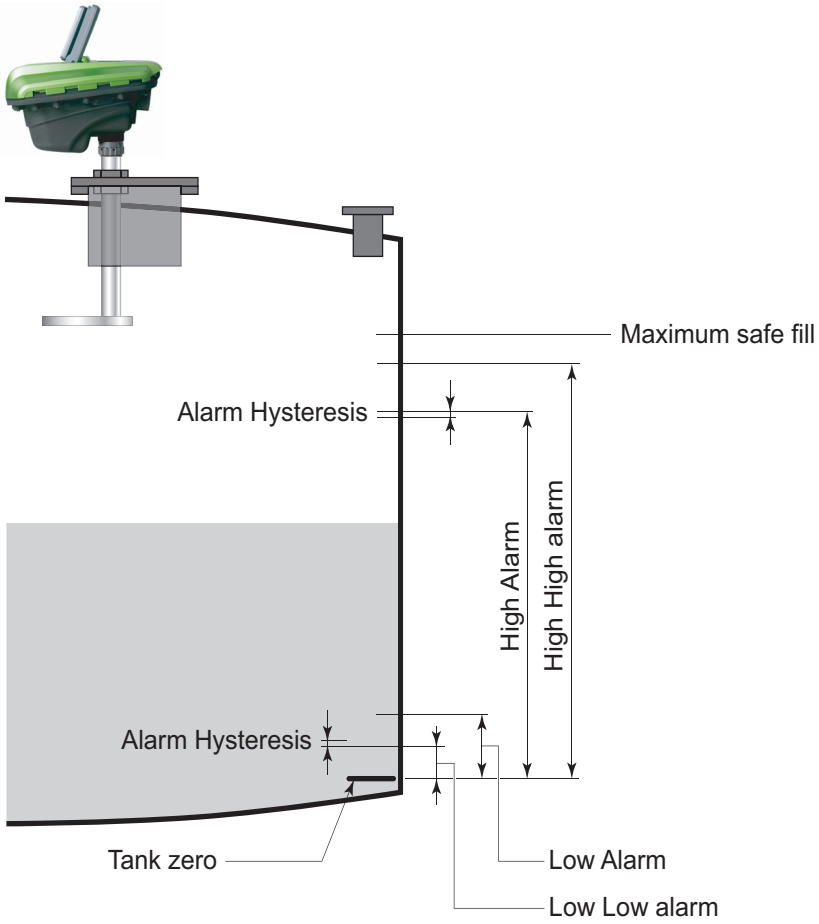



FIGURE 7-11 Alarm and hysteresis definitions

Attention!

- All above mentioned entities MUST be set as the defaults are extremes (1E+12). If they are not, no errors will be displayed, but the [Commissioned] entity will be <False>.
- If the alarm entities are correctly set, but the [Alarm hysteresis] is not, then any alarms that would raise will never be set off! So watch the [Commissioned] status.
- Be aware that the alarm status is only visible in the [Primary value] entity (*innage*)! It is *not* visible in the [Secondary value] entity (ullage).
- Although the GPU-protocol always contains the alarm status, the current software only passes the actual alarm status to this protocol if the gauge is set to *innage* control. So when ullage status is asked for by the GPU-protocol, NO alarm statuses are displayed.
  Workaround solution: Set the GPU records to *innage*.

#### 7.6.2.5 Alarm Loop Checking

Normally, level alarms can be verified when the level reaches the low-level or high-level alarm set point. The level alarms and, if applicable, the hard alarm contact coupled to one of the level alarms can be checked by a “loop check” command. This check is independent from the actual level value.

The level alarm signalling can be checked in several ways:

- via the communication line to the host
- via the hard alarm output contact

Engauge
SmartView

☛To perform the alarm test, set [Alarm test enable] to <Enable> and set [Alarm test] to the required alarm (<High High alarm>, <High Alarm>, <Low Alarm>, or <Low Low alarm>). [Alarm test] is a parameter command, and the command will be executed when the parameter is sent to the gauge. When the command is given, the corresponding alarm will be set for 1 minute.

#### 7.6.2.6 Compensations

##### *7.6.2.6.1 Filtering*

The gauge contains an output filter for both radar innage and radar ullage. The higher the [Filter averaging constant], the more damping on the radar innage and radar ullage values. The filter also introduces a lag between actual ullage/innage and filtered ullage/innage when the product level is changing. The higher the [Filter averaging constant], the larger the lag. The minimum [Filter averaging constant] value is 0 (no filtering), the maximum [Filter averaging constant] value is 99. For the general filter behavior, see FIGURE 7-12.

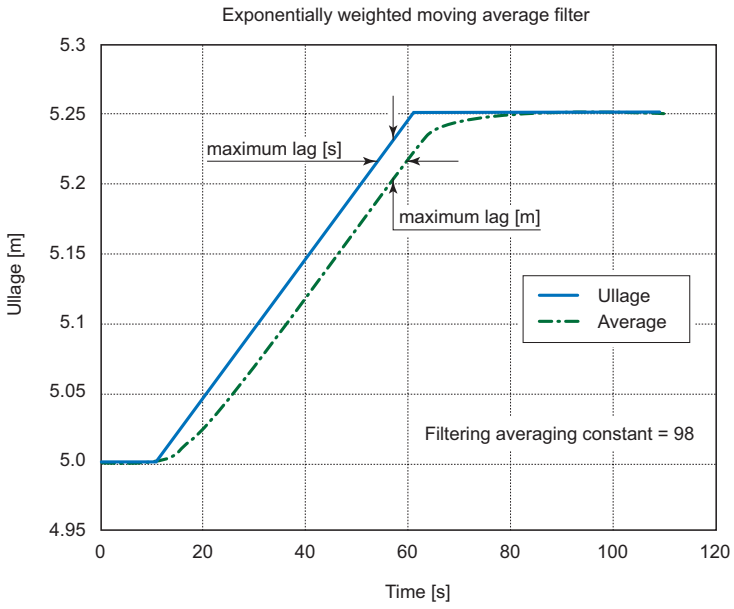



FIGURE 7-12 Filtering characteristic example (level change = 5 mm/s)

In the table below some filtering figures are given.

| [Filter averaging constant] | Approximate noise reduction factor | Maximum lag [s] | Maximum lag [distance] |
|---|---|---|---|
| 50 | 1.4 | 0.1 | 0.1 * dL/s |
| 70 | 1.8 | 0.25 | 0.25 * dL/s |
| 90 | 3 | 1 | 1 * dL/s |
| 95 | 4.5 | 2 | 2 * dL/s |
| 98 | 7 | 5.5 | 5.5 * dL/s |
| 99 | 10 | 11 | 11 * dL/s |

#### *7.6.2.6.2 Verification Pins*

When a radar level gauge is installed on a pressurized tank, both ISO and API suggest to use so-called verification pins to verify the radar level measurement. Prime reason to use said verification pins is the impossibility of doing a manual reference dip. With verification pins it is possible to verify the correct reading of the radar measurement at specific heights while the tank is in operation.

The SmartRadar FlexLine can be switched to measure the pin positions. The reading can then be compared with the known position of the pins. It is advised to have three verification pins:

- Pin 1 at approximately 80 - 90 % of tank height
- Pin 2 at approximately 50 % of tank height
- Pin 3 at approximately 10 - 20 % of tank height

Pin 1 should be above maximum safe fill (so, it can always be measured), however there must be at least 0.6 m (2') free space from pin 1 to cone end. All pin positions should be measured with 1 mm (1/32”) uncertainty with reference to the ball valve.

The SmartRadar FlexLine can measure the position of the three pins when the housing is rotated 90°. The verification pins are then ‘visible’ to the SmartRadar FlexLine.
This can be done without closing the 1" (or 4") ball valve, as the FlexLine housing is located above the tank separator.
After the command “Measure verification pins” is given, the measured positions of the three pins can be requested. The “real” position of the pins (from tank drawing) and the “measured” position of the pins are compared and a correction is applied.
After the SmartRadar FlexLine is placed in the normal (product measuring) mode, the measurement is automatically corrected for the found verification pin positions.

FIGURE 7-13 illustrates the correction method for verification pins.
Once the position of the verification pins is determined, the FlexLine can be switched into verification mode to verify the measured (and corrected) distances with the real pin positions.

If the correction is properly made, both values of each of the three pins should be equal to each other.

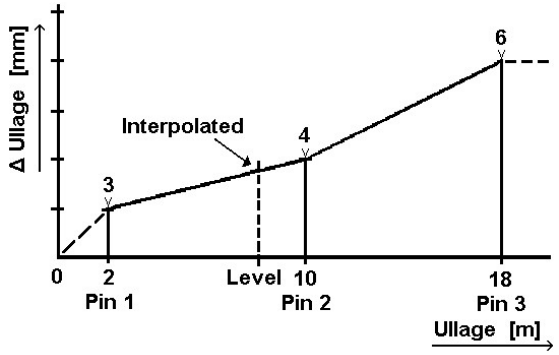



FIGURE 7-13 Ullage correction using the verification pins

If the product level in the tank is above pin position 1 or below pin position 3, the correction is extended by the following estimation:

- above pin1: there is an interpolation from the radar zero point (no correction) to the position of pin 1 (with its correction).
- below pin 3: the correction found at pin 3 is valid for the range below pin position 3.

At installation of the verification pins, the distances of the pins towards the flange of the stilling well (L1, L2, and L3) are noted.

The FlexLine measures ullage from the radar zero point.

*NOTE: The radar zero point from the FlexLine with an H04 Antenna is located at the flange of the tank separator. See FIGURE 7-14.*

In case the 1" ball valve is used (that is with antenna models H04/N1 and H04/N4), an offset must be added to the distances of the verification pins.

*Engauge SmartView*

☛ The above found verification pin distances must be entered in the following entities:

| Entity name | Explanation |
|---|---|
| Verification pin physical position 1 | Physical ullage of verification pin 1 with respect to radar zero |
| Verification pin physical position 2 | Physical ullage of verification pin 2 with respect to radar zero |
| Verification pin physical position 3 | Physical ullage of verification pin 3 with respect to radar zero |

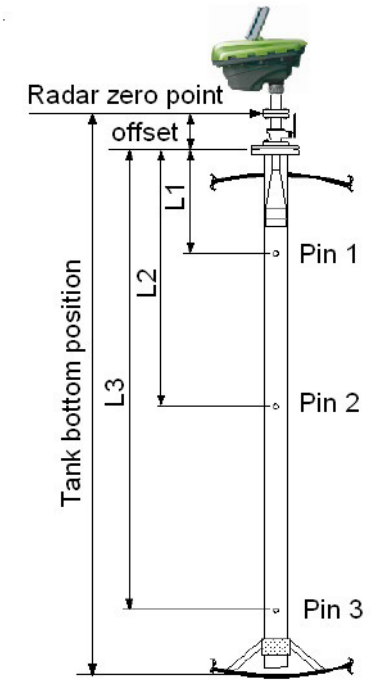



FIGURE 7-14 Radar zero point and verification pins positions

In normal (product measuring) position (see FIGURE 7-15), the E-field (electrical field of the microwave) is located perpendicular to the direction of the verification pins. In this position, the verification pins are less visible to the SmartRadar FlexLine.

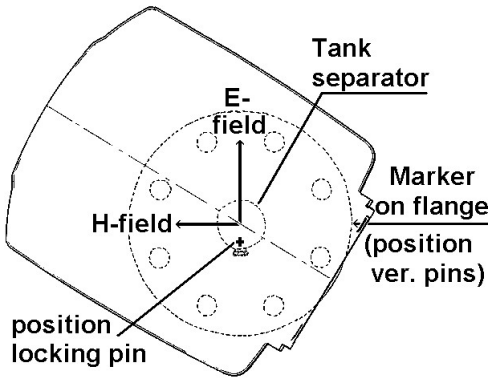



FIGURE 7-15 Product measuring position

In verification pin measuring position (see FIGURE 7-16), the E-field should be in parallel with the verification pin direction. Then the

reflections from the verification pins are stronger and recognized by the SmartRadar FlexLine.

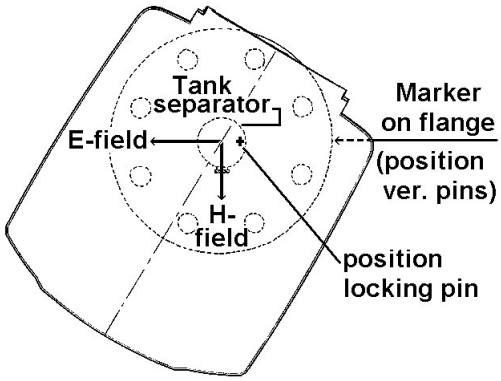



FIGURE 7-16 Verification pin measuring position

To measure the position of the verification pins, the SmartRadar FlexLine must be turned 90 degrees as follows:

- Release the coupling nut of the SmartRadar FlexLine housing.
- Lift the SmartRadar FlexLine housing from tank separator.
- Rotate the SmartRadar FlexLine for 90°. This can only be done in one direction because of the locking pin.
- Place SmartRadar FlexLine on tank separator; mind locking pin.
- Secure the coupling nut of the SmartRadar FlexLine housing.

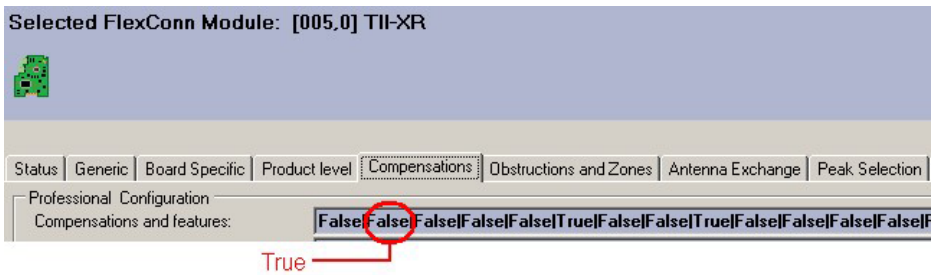
Then issue the command: [Measure verification pins] (on *SmartView*: Calibrate v-pins).

When the verification pin measurement is completed, the SmartRadar FlexLine housing must be turned back 90° (follow above procedure in reverse order).

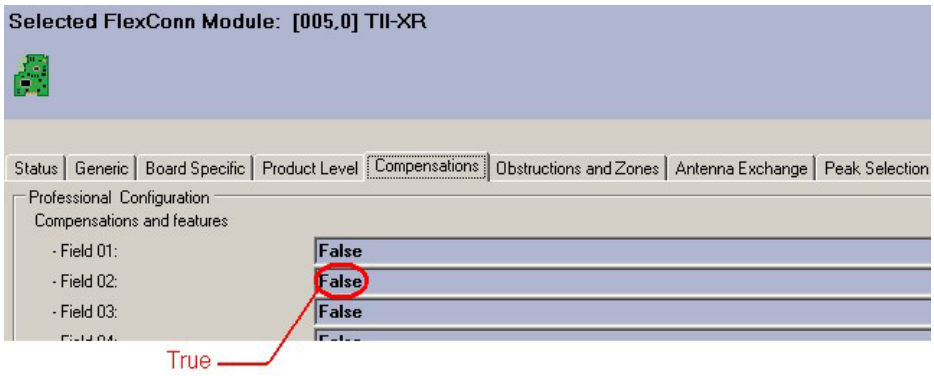
*Engauge*
*SmartView*

The verification-pin compensation must be **enabled** by the appropriate switch. In Engauge, that is (depending on installed TII-XR firmware and board descriptor):

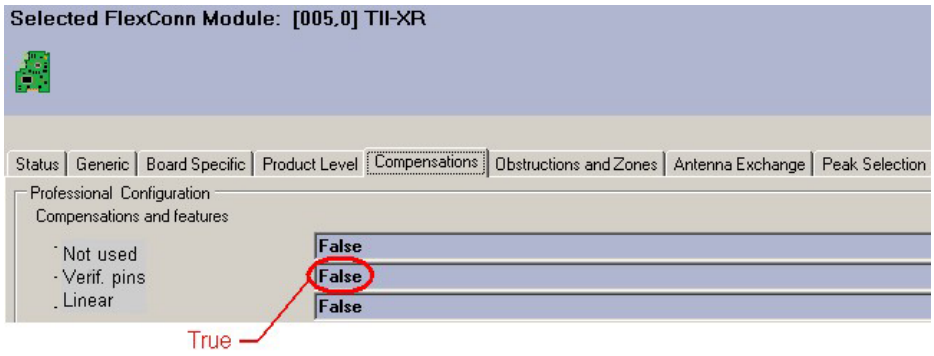
″ the second position of correction field:
(up to TII-XR firmware version A1130 and board descriptor V4)



″ or, Field02:
(with TII-XR firmware version A1131 and board descriptor V5)




″ or, Verification pins:
(from TII-XR firmware version A1140 and board descriptor V6)




*Engauge*
*SmartView*

For the *SmartView* the command is implemented from TII-XR firmware version A1142, and resides under the Command menu as follows:

☛From the menu select:

- [Commands]
- board [TII-XR] and
- [Product level].

☛Then scroll through the list of commands, and select the command [Enable v-pins].

To **disable** the verification pin compensation, proceed as follows:

*Engauge*
*SmartView*

- By *Engauge*:

☛Set the appropriate field in the Compensation TAB to <False>.

- By *SmartView*:

☛From the menu select:

- [Commands]
- board [TII-XR] and

- [Product level].

☛Then scroll through the list of commands, and select the command [Disable v-pins].

Below an example of two *reflection diagrams* from product measuring mode and verification-pin measuring mode, and an example of the *compensation sheet*.

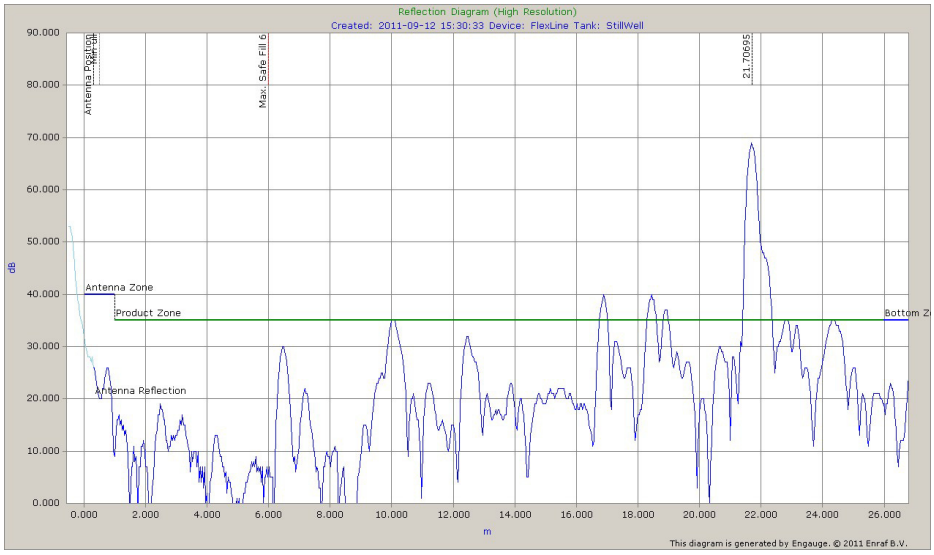



FIGURE 7-17 Product measuring mode, reflection diagram example

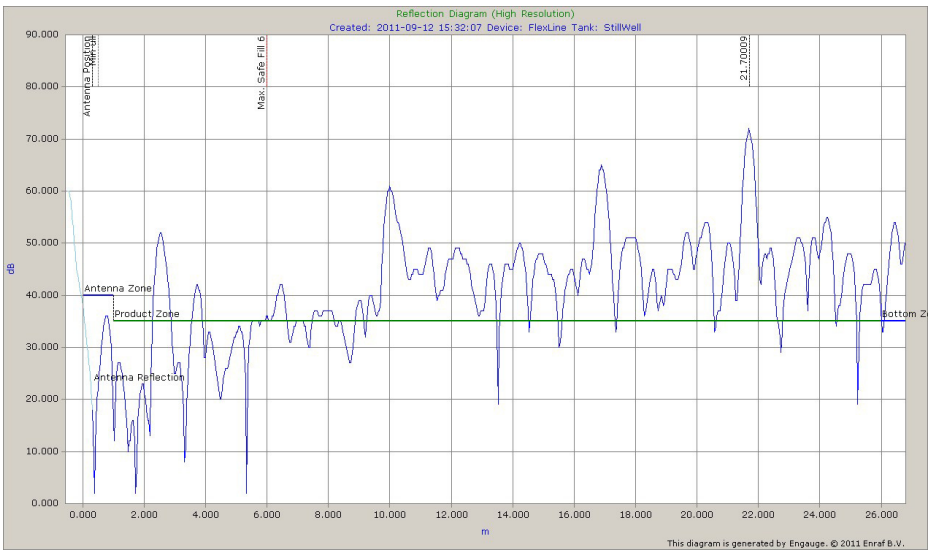



FIGURE 7-18 Verification pin measuring mode, reflection diagram example

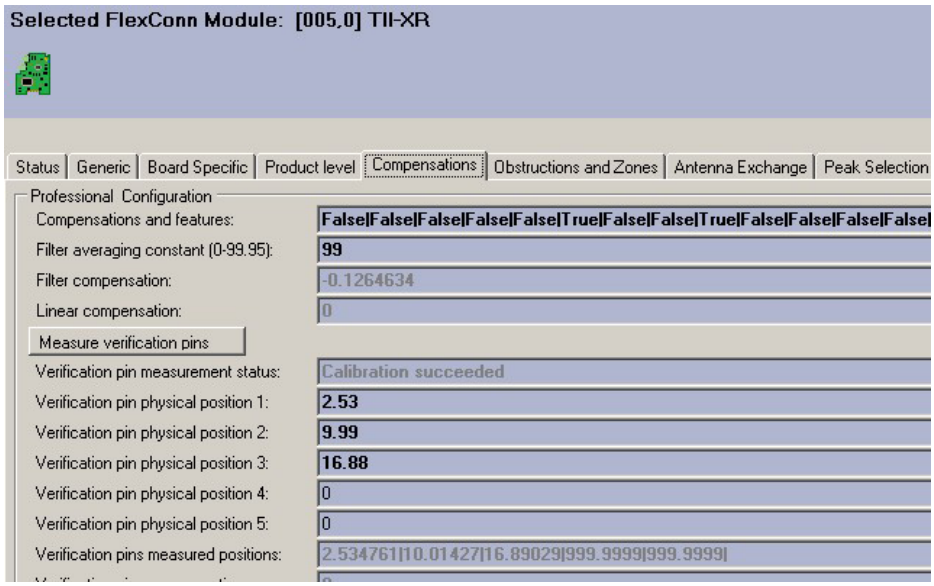



FIGURE 7-19 Verification pin compensation, example

#### 7.6.2.7 Errors and Warnings

The status code of the [Primary value] or the [Secondary value] can display an error (status = <BAD>) or a warning (status = <UNCERTAIN>).

Most common error messages are:

| Message | Cause |
|---|---|
| Radar max safe fill not set error | [Maximum safe fill] still set to 0 (zero) |
| Radar max safe fill out of range | [Maximum safe fill] value too high |

#### 7.6.2.8 Additional Information

Following information can be extracted from the TII-XR system:

| Entity | Description |
|---|---|
| [DSP firmware version] | Besides a generic processor, the TII-XR has a Digital Signal Processor for algorithm calculations. See also FIGURE 7-7. |
| [Production date] | Production date of the complete SmartRadar FlexConn system. |
| [ART2A serial number] | The serial number of the high-frequency module. This module does all measurements. |
| [Device serial number] | Serial number of the complete SmartRadar FlexConn system. |
| [Antenna serial number] | Serial number of the measuring antenna. |

#### 7.6.2.9 Overfill Protection Application

For the configuration of the TII-XR within an Overfill protection application, see 7.7.11.

## 7.7 Relay Contacts (FII-DO)

### 7.7.1 Introduction

The Field Interface Instrument - Digital Output (FII-DO) board has 4 software-controlled, electromechanical relays; see FIGURE 7-20.

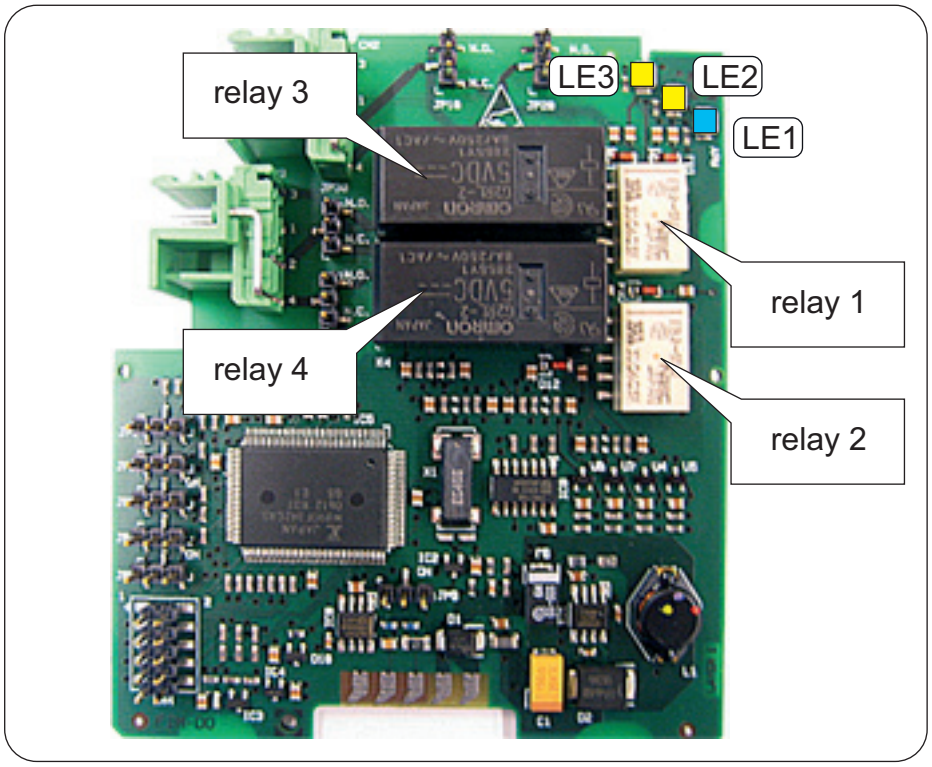



FIGURE 7-20 The relays and LEDs on the FII-DO board

F4A07-0001

These relays are allocated to FlexConn functions as shown below:

| Function Number | Function |
|---|---|
| 1 | Relay 1 |
| 2 | Relay 2 |
| 3 | Relay 3 |
| 4 | Relay 4 |

The relays have output status read-back lines.

With jumpers, the relays can individually be set to Normally Open (NO) or Normally Closed (NC).

In addition to the board's [Health] LED LE1, the LEDs LE2 and LE3 are available (see FIGURE 7-20). They can be associated to a relay, by setting the [LED Association] entity.

☛For a *fail-safe level application*, continue with section 7.7.10.

### 7.7.2 Operation Mode

The FII-DO can operate in one of two modes: [Alarm Mode] and [Fallback Mode]. This is controlled by the [Operation Mode] entity.

Fallback Mode is *not* implemented yet.

Engauge
SmartView

☛Set the [Operation Mode] entity to [Alarm Mode].

### 7.7.3 Relay Configuration

#### 7.7.3.1 Jumper Settings

At installation, each individual relay contact was configured as required with the hardware jumpers JPx0, where x = Relay 1 to 4 respectively. See FIGURE 7-21.

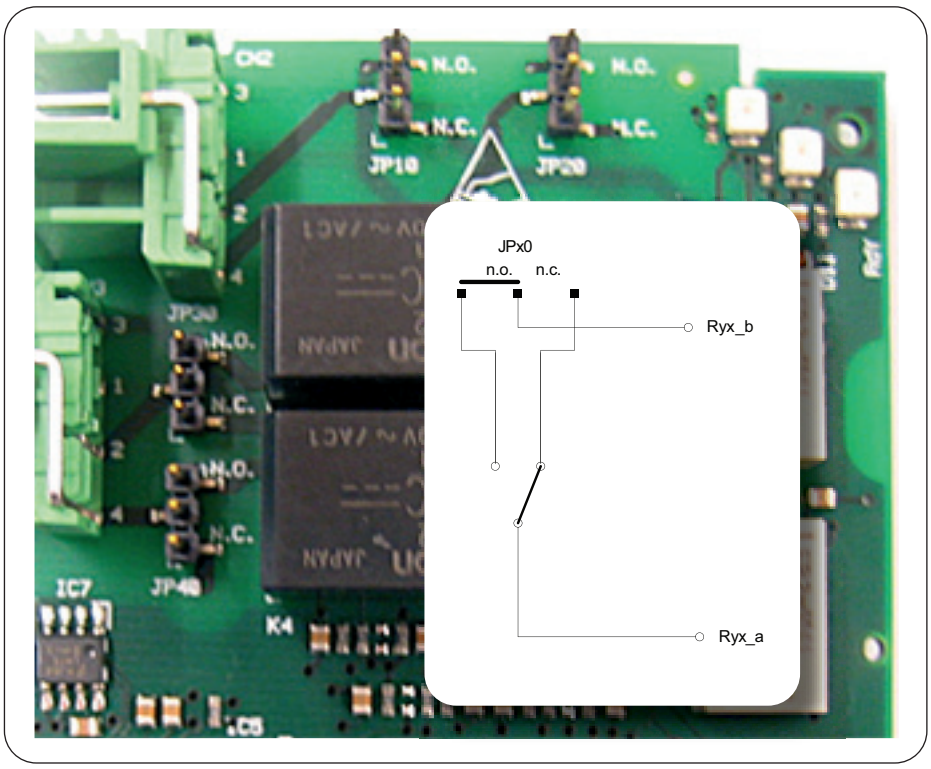



FIGURE 7-21 The relays' hardware jumpers

F4A07-0002

*NOTE: In the Commissioning stage, no jumper setting can be changed without breaking the compartment screw sealing.*

#### 7.7.3.2 Relay Mode

Each individual relay can be set to be *energized* or *de-energized* during operation, by setting the [Relay Mode] entity to <Energized> or <De-energized> respectively.

If the [Relay Mode] entity is set to <Energized>, the relay coil will be energized when the relay state is <Deactivated>, and the relay coil will be de-energized when the relay state is <Activated>.

If the [Relay Mode] entity is set to <De-Energized>, the relay coil will be de-energized when the relay state is <Deactivated>, and the relay coil will be energized when the relay state is <Activated>.

The <Energized> option is used for *fail-safe* operation whereas the <De-Energized> option is used for *non-fail-safe* operation.

Engauge SmartView

☛ Set each individual relay to the required configuration, by selecting the proper entities. See also next overview (fail-safe configuration is coloured).

| Physically Configured | Relay Mode | Relay State | Physical Result |
|---|---|---|---|
| Normally Open (NO) | De-Energized | Activated | Closed |
| | | Deactivated | Open |
| | Energized | Activated | Open |
| | | Deactivated | Closed |
| Normally Closed (NC) | De-Energized | Activated | Open |
| | | Deactivated | Closed |
| | Energized | Activated | Closed |
| | | Deactivated | Open |

### 7.7.4 Alarm Mode

Each individual relay can operate in one out of three modes, by setting the [Alarm Mode] entity to either [PV Monitor], [Remote Control], or [Not In Use].

#### 7.7.4.1 PV Monitor

In [PV Monitor] mode, each individual FII-DO-relay unit can monitor the Primary Value (PV) or Secondary Value (SV) of another board connected to the CAN bus, and either activate or deactivate the associated relay if a certain condition is <True> or <False>.

☛ If [Remote Control] or [Not In Use] mode must be selected, skip to section 7.7.4.2 or 7.7.4.3 respectively.

Engauge SmartView

☛ From the [Alarm Mode] menu, select [PV Monitor].

☛ Select [Monitor Board ID], set proper value.

☛ Select [Monitor Board Instance], set proper value.

☛ Select [Monitor Function Instance], set proper value.

☛ Select [Monitor Source], select either <PV> or <SV>, as desired.

The [Monitor Board ID], [Monitor Board Instance], and [Monitor Function Instance] entities determine the *location* of the entity to be scanned.

The [Monitor Source] entity determines if either the Primary Value <PV> or Secondary Value <SV> entity shall be scanned.

The behavior of each individual relay in PV Monitor mode is further controlled by the [Monitor Mode] and the [Status Behavior] entities; see next.

#### 7.7.4.1.1 Monitor Mode

The [Monitor Mode] entity can either be set to [Remote] or [Local].

- If the [Monitor Mode] is set to [Remote], the *alarm status* of the scanned PV or SV is monitored. The alarm status is compared against the value set in the [Remote Threshold Source] entity. The [Remote Threshold Source] entity can be set to <HH>, <HA>, <LA>, or <LL>.

*Example:* If the [Remote Threshold Source] is set to <HH> and a High High Alarm occurs, the relay will be activated. It will not be activated by any other alarms.

Engauge / SmartView

☛ If [Local] [Monitor Mode] is to be set, skip to next bullet (■).

☛ From the [Monitor Mode], select [Remote].

☛ Select [Remote Threshold Source], set desired value.

- If the [Monitor Mode] is set to [Local], the scanned PV or SV value is compared against the value set in the [Threshold] entity. The behavior is modified by the [Threshold Mode] and the [Hysteresis] entities. The [Threshold Mode] entity can be set to either <Treat as HA> or <Treat as LA>.

  If the [Threshold Mode] entity is set to <Treat as HA>, the relay is activated if the scanned PV or SV is greater than or equal to the [Threshold] entity value, and the relay is deactivated if the scanned PV or SV is less than the [Threshold] entity value minus the [Hysteresis] entity value.

  If the [Threshold Mode] entity is set to <Treat as LA>, the relay is activated if the scanned PV or SV is greater than or equal to the [Threshold] entity value, and the relay is deactivated if the scanned PV or SV is less than the [Threshold] entity value plus the [Hysteresis] entity value.

Engauge / SmartView

☛ From the [Monitor Mode], select [Local].

☛ Select [Threshold Mode], and choose either <Treat as HA> or <Treat as LA>.

☛ Select [Hysteresis], set desired value.

#### 7.7.4.1.2 Status Behavior

The Status Behavior entity determines what happens to the relay if the health of the scanned PV or SV differs from Good. The [Status Behavior] should be set to one of the following options: <BAD>, <BAD-UNCERTAIN>, or <Not Used>.

- If the [Status Behavior] is set to <BAD>, and the scanned PV or SV health is Bad, the respective relay will be activated.
- If the [Status Behavior] is set to <BAD-UNCERTAIN>, and the scanned PV or SV health is Bad or Uncertain, the respective relay will be activated.
- If the [Status Behavior] is set to <Not Used>, the respective relay will *not* be activated if the scanned PV or SV health is Bad or Uncertain.

Engauge / SmartView

☛ Set the [Status Behavior] entity either to <BAD>, <BAD-UNCERTAIN>, or <Not Used>.

*NOTE: This behavior takes priority over the [Remote] or [Local] monitoring. For example: If the [Status Behavior] is set to <BAD>, and the scanned PV or SV health is Bad, the respective relay will be activated regardless of the [Monitor Mode] entity settings. The [Remote] or [Local] option PV or SV checks will then not affect the relay status.*

#### 7.7.4.2 Remote Control

In [Remote Control] mode, each individual relay can directly be activated or deactivated, by sending an !Activate! respectively a !Deactivate! command via the CAN bus.

The behavior of each individual relay is further controlled by the [Remote Control] mode entity, which can be set to either <Restricted> or <Not Restricted>.

- If the [Remote Control] mode entity is set to <Not Restricted>, any source can be used to control the relay with an !Activate! or a !Deactivate! command.
- If the [Remote Control] mode entity is set to <Restricted>, the relay can only be controlled by the source that matches the values set in the [Control Board ID], the [Control Board Instance], and the [Control Function Instance].

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☛From the [Remote Control] mode menu, select either <Restricted> or <Not Restricted>.

☛If Not Restricted was selected, skip to 7.7.4.3.

☛Select [Control Board ID], set proper value.

☛Select [Control Board Instance], set proper value.

☛Select [Control Function Instance], set proper value.

#### 7.7.4.3 Not in Use

If an individual relay is not required in a particular application, the [Alarm Mode] entity must be set to <Not In Use>.

*Example:* If a particular application requires only two relays to be used, say relay 1 and 2, then for relay 3 and 4 the [Alarm Mode] entities must be set to <Not In Use>.

Engauge SmartView

☛For the FII-DO relays *not used* within the application, set the [Alarm Mode] entities to <Not In Use>.

### 7.7.5 Commands

The following commands can be given to the FII-DO:

- Activate
- Deactivate
- Acknowledge

#### 7.7.5.1 Activate

The !Activate! command will cause the specified relay to become <Activated>. This command is only available in [Remote Control] mode; see 7.7.4.2.

The !Activate! command behavior is modified by the [Time Setting] entity. If the [Time Setting] entity is set to zero, the relay will stay permanently activated until a !Deactivate! command is given.

If the [Time Setting] entity is set to a value other than zero, the relay will be activated for a time in seconds equal to the value set in the [Time Setting] entity, then deactivated. During the period the relay is activated, the relay state will be !Time Setting Active!. This is useful for site commissioning.

Engauge SmartView

☛For each relay, set the [Time Setting] entity to the desired value.

#### 7.7.5.2 Deactivate

The !Deactivate! command will cause the specified relay to become <Deactivated>. This command is only available in [Remote Control] mode; see 7.7.4.2.

#### 7.7.5.3 Acknowledge

The !Acknowledge! command will cause the specified relay to be physically deactivated, but the relay status will be set to !Acknowledged!. This command is only available in [PV Monitor] mode; see 7.7.4.1. This command can only be given when the concerned relay has already been activated.

For example, this command is useful if the relay is connected to an alarm system. The alarm can be silenced by the command, but it is still possible to determine if an alarm has occurred. When the alarm condition is then removed, the relay state will become deactivated, and normal operation will resume.

### 7.7.6 LED Association

Depending on the value set in the [LED Association] entity, the 4 individual relays on the FII-DO board can be associated with one out of 2 LEDs, LE2 or LE3 (see FIGURE 7-20).

The associated LED will be ON when the relay state is <Activated>, and the LED will be OFF when the relay state is <Deactivated>.

*NOTE: The LEDs do **not** indicate the **physical** relay state (coil state or contacts state), as this depends on the software settings and the physical settings (jumper), see 7.7.3.*

Engauge SmartView

☛ Set the value of the [LED Association] entity as desired (optional). For an example, see table below.

| LED Association | LED Number | Relay Number |
|---|---|---|
| 1 + 2 | LE2 | 1 |
| | LE3 | 2 |
| 3 + 4 | LE2 | 3 |
| | LE3 | 4 |

### 7.7.7 Terminal Allocation

| Terminal Number | Name | Function |
|---|---|---|
| 14 | Ry1_a | Relay 1 Common |
| 15 | Ry1_b | Relay 1 NO or NC* |
| 16 | Ry2_a | Relay 2 Common |
| 17 | Ry2_b | Relay 2 NO or NC* |
| 18 | Ry3_a | Relay 3 Common |
| 19 | Ry3_b | Relay 3 NO or NC* |
| 20 | Ry4_a | Relay 4 Common |
| 21 | Ry4_b | Relay 4 NO or NC* |

*) See jumper settings, section 7.7.3.1.

### 7.7.8 Commissioned Entities

Engauge SmartView

☛By using the table below, make sure all entities are commissioned.

The [Commissioned] entity will display either <True> if the function is commissioned or <False> if the function is not commissioned. To commission the function, the entities must be set in accordance with the table below.

| Operation Mode | Alarm Mode | Remote Control Mode | Parameters | Commissioned |
|---|---|---|---|---|
| Alarm Mode | Remote Control | Restricted | [Control Board ID] >=1 and <=255<br>[Control Board Instance] >=0 and <=7<br>[Control Function Instance] >=1 and <=15<br>[Time Setting] = 0 | <True> |
| | | | [Control Board ID] <1 or >255<br>[Control Board Instance] <0 and >7<br>[Control Function Instance] <1 and >15<br>[Time Setting] ≠ 0 | <False> |
| | | Not Restricted | [Time Setting] = 0 | <True> |
| | | | [Time Setting] ≠ 0 | <False> |
| | PV Monitor | Remote | [Monitor Board ID] >=1 and <=255<br>[Monitor Board Instance] >=0 and <=7<br>[Monitor Function Instance] >=1 and <=15<br>[Time Setting] = 0 | <True> |
| | | | [Monitor Board ID] <1 or >255<br>[Monitor Board Instance] <0 and >7<br>[Monitor Function Instance] <1 and >15<br>[Time Setting] ≠ 0 | <False> |
| | | Local | [Monitor Board ID] >=1 and <=255<br>[Monitor Board Instance] >=0 and <=7<br>[Monitor Function Instance] >=1 and <=15<br>[Time Setting] = 0<br>[Threshold] = value entered<br>[Hysteresis] = value entered | <True> |
| | | | [Monitor Board ID] <1 or >255<br>[Monitor Board Instance] <0 and >7<br>[Monitor Function Instance] <1 and >15<br>[Time Setting] ≠ 0<br>[Threshold] = value entered<br>[Hysteresis] = value entered | <False> |
| | Not In Use | N/A | N/A | <True> |
| Fallback Mode | N/A | N/A | N/A | <False> |

### 7.7.9 Board Commissioned Entity

The [Board Commissioned] entity will display either <True> if all functions are commissioned or <False> if any of the functions are not commissioned.

Engauge SmartView

☛ If the [Board Commissioned] entity displays <False>, check each function parameter again. Use the table from 7.7.8.

### 7.7.10 Fail-safe Level Application

Following steps include all commissioning-aspects settings for the Fail-safe level application.

☛ The corresponding jumper of the concerned relay must be in the Normally Open (NO) state (= *default* setting).

*NOTE: In the Commissioning stage, no jumper setting can be changed without breaking the compartment screw sealing. See also section 7.7.3.1.*

Engauge SmartView

☛ Set [Operation Mode] to [Alarm Mode].

☛ Set [Relay Mode] to <Energized>.

☛ Set [Alarm Mode] to [PV Monitor].

☛ Set [Monitor Board ID] to <board id> of product-level board.

☛ Set [Monitor Board Instance] to <board instance> of related product-level board.

☛ Set [Monitor Function Instance] to <function instance> of related product-level board.

☛ Set [Monitor Source] to <PV>.

☛ Set [Monitor Mode] to [Remote].

☛ Set [Remote Threshold Source] to <HH>, <HA>, <LA>, or <LL>.

☛ Set corresponding alarm setting of the related product-level board.

☛ Set [Status Behavior] to <BAD-UNCERTAIN>

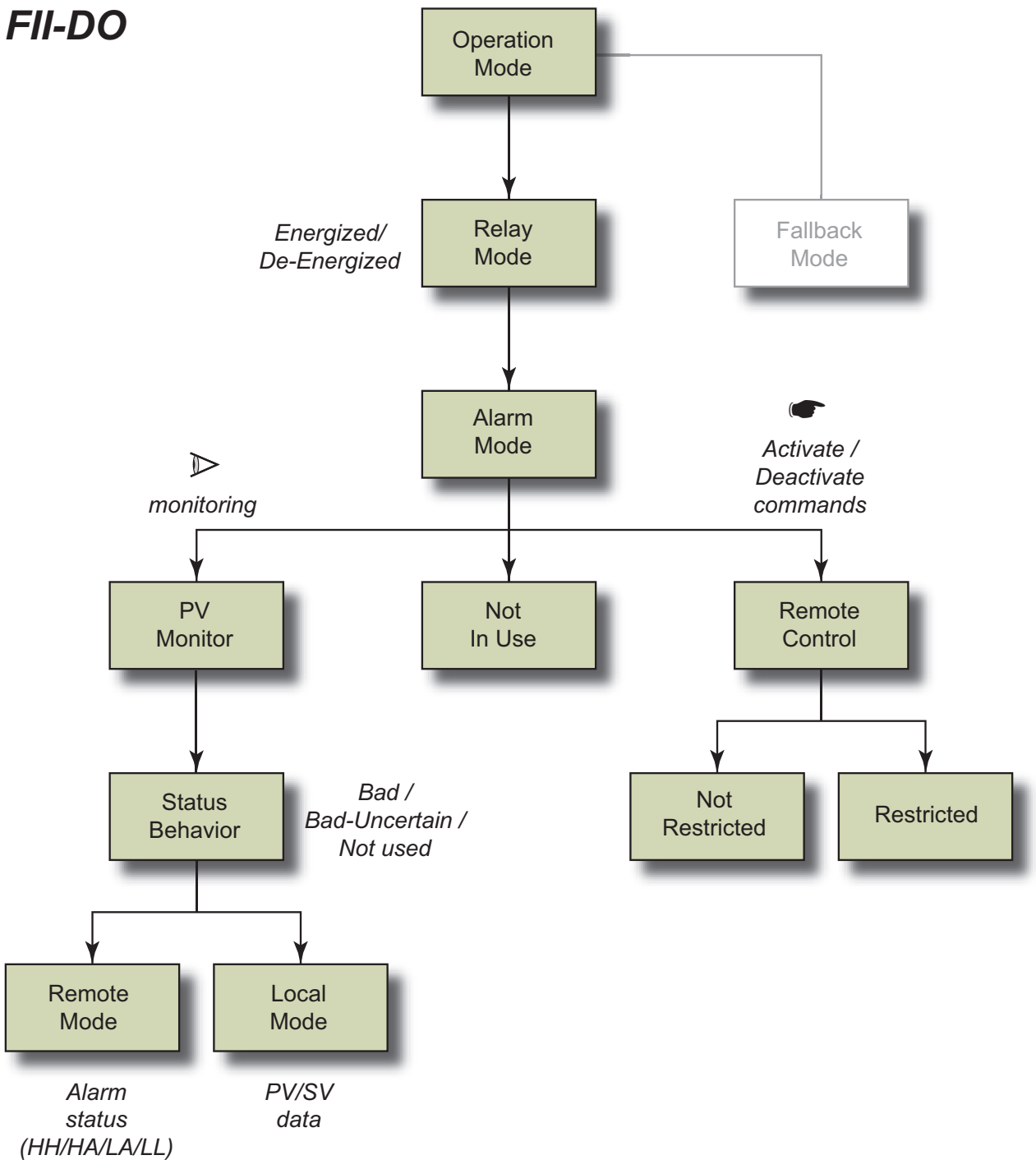



FIGURE 7-22 FII-DO operation mode survey

F4A07-0004

### 7.7.11 Overfill Protection Application

#### 7.7.11.1 Introduction

Because of some tank storage overfill accidents in the past, there is an increased need for a qualified overfill-protected level measuring system.

The SmartRadar FlexLine can be configured such that an adequate overfill protection level is achieved. As such it is qualified as a Safety Instrumented Function (SIF) for overfill protection of storage tanks in the oil and gas industry, to a SIL[1] 2 level.

**The safety parameters are within the range of SIL 2 if the following conditions are met:**

- **The SmartRadar FlexLine uses the Overfill Protection Application with the dual redundant configuration of the FII-DO as described in this manual, and**
- **All relevant entities are commissioned as decribed in this manual.**

#### 7.7.11.2 Essential FlexConn Boards

The essential FlexConn boards for an overfill protection application are:

- FII-DO (1)
- FII-DO (2)
- TII-XR
- PSX

#### 7.7.11.3 Application Principle

- In order to achieve the correct SIL, **2 SmartRadar FII-DO modules are combined into a special safety configuration**.
- For this special configuration, **only relay 3 and relay 4 are used**. For their locations, see FIGURE 7-23.

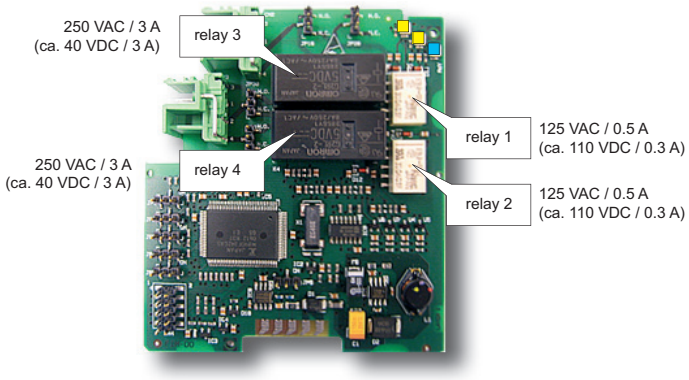



FIGURE 7-23 Locations and ratings of the Electro Mechanical Relays on the FII-DO board F4A10-0001

1. SIL = Safety Integrity Level.

- The relays must be set to **Normally Open** (jumper, see 7.7.3.1) and **Normally Energized** (configuration parameter, see 7.7.3.2).
- In a normal situation, the relay contacts are closed.
- Relays 4 are used to increase the availability: if a problem is detected with the other relays, the redundancy takes care that the overfill protection function will work (see also FIGURE 7-24).
- The relays typically can stop a pump or close a valve that is used filling a storage tank. See FIGURE 7-24.
- Overfill safety analysis, including diagnostic tests is done every second.
- The 2 FII-DO boards are continuously checking each other for a correct functioning. This is done every second. In case of malfunction, 2 retries are executed before the status is definitely determined.
- The radar scans the overfill protection status every second and will react accordingly.

#### 7.7.11.4 Overfill Protection Board Actions

The following table shows the important parameters for overfill protection.

| | |
|---|---|
| **Output** = Function PV | |
| 1 | = relay contact closed |
| 0 | = relay contact opened (safe situation) |
| **Diagnostics** = Function health + Board health | |
| 1 | = status = GOOD, healthy |
| 0 | = status = BAD, UNCERTAIN, not healthy (force safe situation) |
| **Level** = product level analysis | |
| 1 | = product level < threshold |
| 0 | = product level >= threshold (force safe situation) |
| 0 | = product level status = BAD, UNCERTAIN, not healthy |
| 0 | = no communication with the TII-XR |
| **Voltage** = all FlexConn monitored voltages | |
| 1 | = voltage within specifications (OK) |
| 0 | = voltage too high (one or more) (force safe situation) |
| **Counter part communication** = communication with other relay board | |
| 1 | = valid communication |
| 0 | = no communication (force safe situation) |

- **Both board contacts are always opened** if **one** out of the following events occurs:
  - **Level = 0** (product level >= threshold, product level TV = BAD/ UNCERTAIN, TII-XR board does not respond)
  - **Voltage = 0** (one of more board voltages out of range)
  - **Board diagnostic = 0** (board status = BAD / UNCERTAIN)
  - **Board diagnostic of counter part (redundant board) = 0** (board status = BAD / UNCERTAIN)
  - **Counter part (redundant board) communication = 0** (other relay board does not respond)

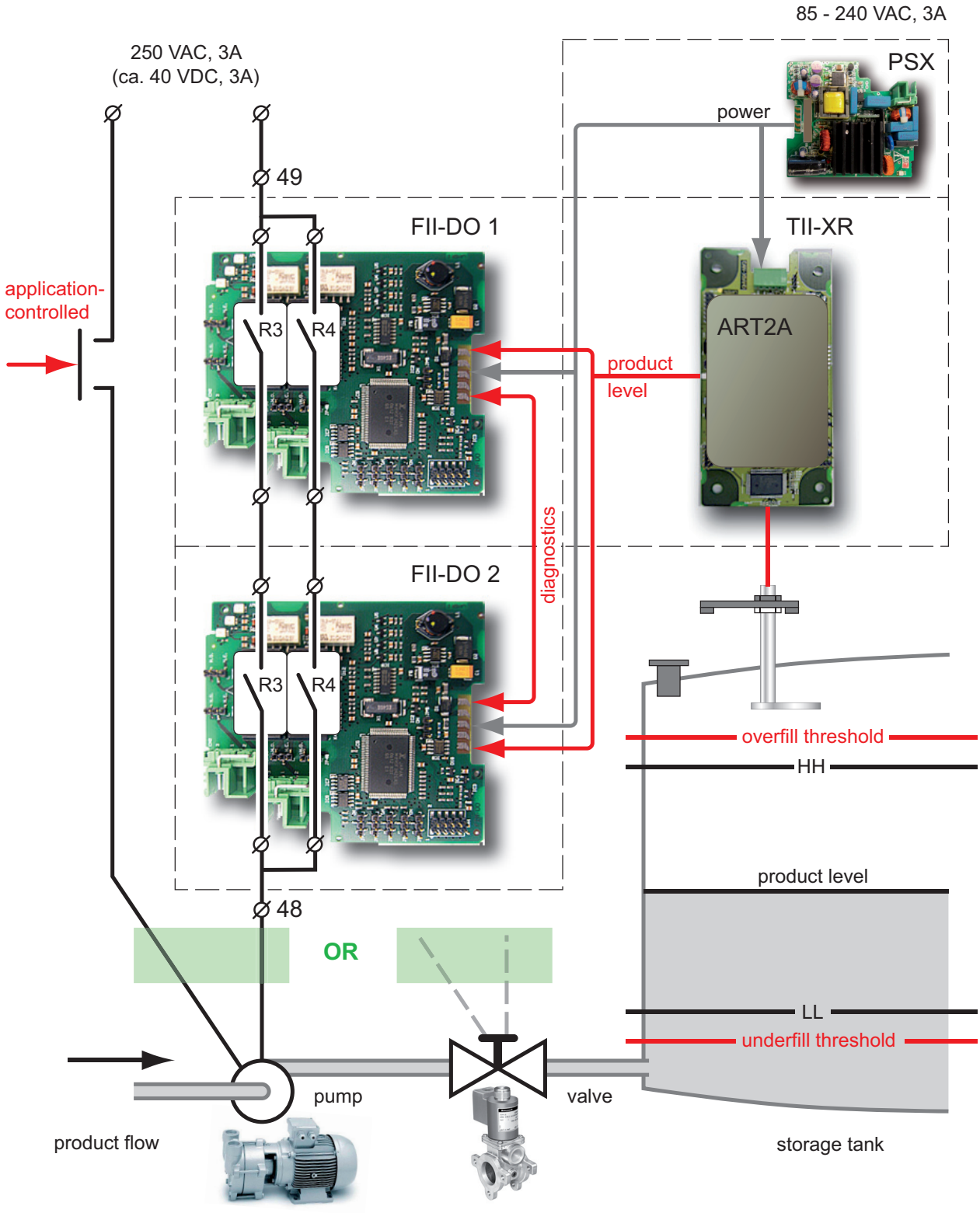



FIGURE 7-24 Overfill protection application using 2 FII-DO boards

F4A10-0002

- **An individual board relay contact is closed** if **all** following conditions are met:
  - **Level = 1** (product level < threshold, product level TV = GOOD, valid communication with TII-XR)
  - **Voltage = 1** (board voltages within ranges)
  - **Board diagnostic = 1** (board status = GOOD)
  - **Board diagnostic counter part = 1** (board status = GOOD)
  - **Counter part = 1** (other relay board responds)
  - **Relay (Rn) diagnostic = 1** (function status = GOOD)
  - **Relay (Rn) diagnostic counter part = 1** (function status = GOOD)

*NOTE: Both boards needs to be configured **identically** for relay behaviour, threshold, and hysteresis.*

The following matrix gives an overview of the relations between the status and resulting events:

SD = Shut Down | O = Overfill alarm | N = No

NO = Normal Operation | W = Gauge alarm (warning) | Y = Yes

H = Healthy

| | 1 | 2 | 3 | 4 | 5 | | | | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Own board status** | | | | | | | | | | | | | | | | | |
| **Level** (incl. TII-XR comms + TV Health + status check) | 0 | X | X | X | X | | | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| **Voltage** | X | 0 | X | X | X | | | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| **Diag board** | X | X | 0 | X | X | | | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| **Diag R3** | X | X | X | X | X | | | | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 |
| **Diag R4** | X | X | X | X | X | | | | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 1 | 1 |
| **Counter part (redundant board) communication** | X | X | X | 0 | X | | | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| **Other board status** | | | | | | | | | | | | | | | | | |
| **Diag board** (incl. Voltage) | X | X | X | X | 0 | | | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| **Diag R3** | X | X | X | X | X | | | | 0 | 1 | 1 | 0 | 1 | 1 | 0 | 1 | 1 |
| **Diag R4** | X | X | X | X | X | | | | 1 | 0 | 1 | 1 | 0 | 1 | 1 | 0 | 1 |
| **Board action** | | | | | | | | | | | | | | | | | |
| **Output R3** | 0 | 0 | 0 | 0 | 0 | | | | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 1 | 1 |
| **Output R4** | 0 | 0 | 0 | 0 | 0 | | | | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 1 |
| **Application status** | SD | SD | SD | SD | SD | | | | NO | SD | NO | SD | NO | NO | NO | NO | NO |
| **Overfill Protection Status** | O | W | W | W | W | | | | W | W | W | W | W | W | W | W | H |
| **Start safety timer** | N | N | N | N | N | | | | Y | N | Y | N | Y | Y | Y | Y | N |

#### 7.7.11.5 Merging the Status to GPU-level status

The TII-XR firmware implements an alarm for the operator by merging the output status of each board with the GPU level status, in order to communicate shut down information to the control room. See following matrix.

*NOTE: For field installations upgraded with the Overfill Protection functionality, the TII-XR firmware must be upgraded.*

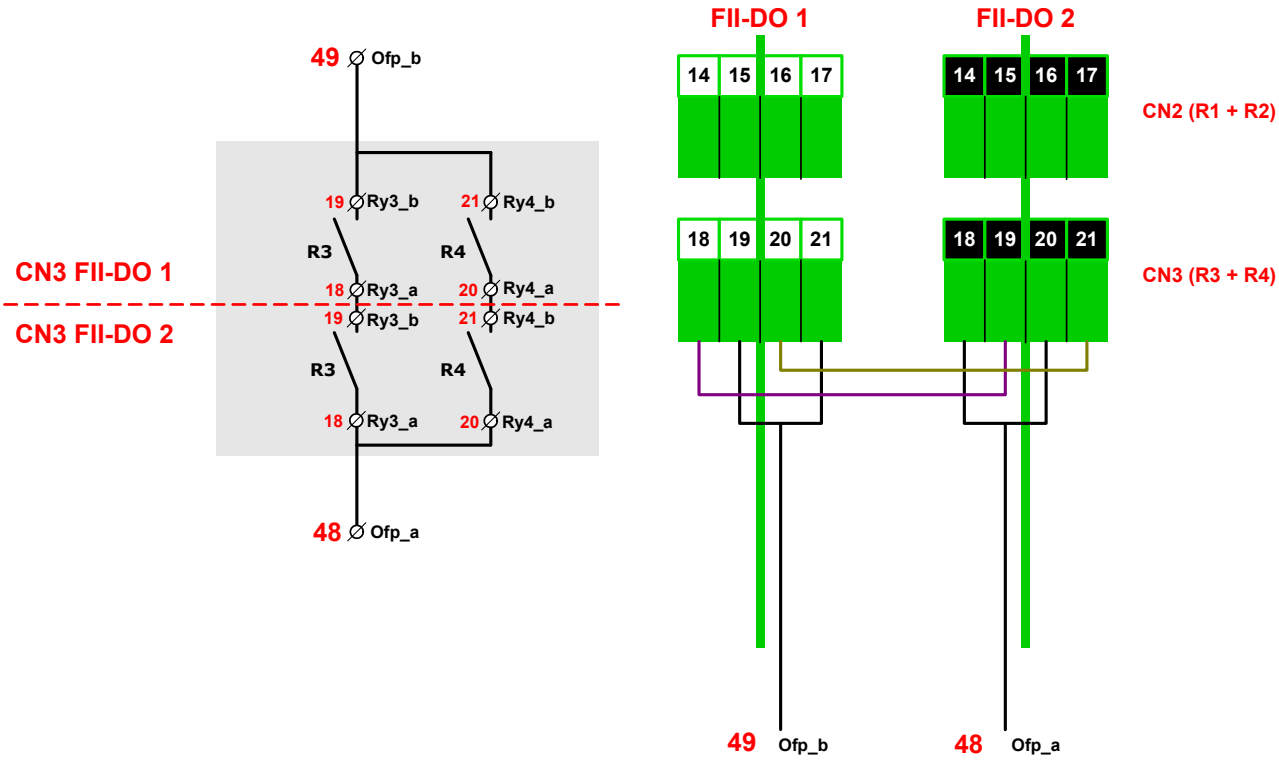
F = Fail
? = Warning, reduced accuracy
- = valid

| FII-DO 1 | FII-DO 2 | TII-XR |
|---|---|---|
| Overfill Protection status | Overfill Protection status | level status GPU protocol |
| O | O | F |
| O | H | F |
| O | W | F |
| W | O | F |
| W | H | ? |
| W | W | ? |
| H | O | F |
| H | H | - |
| H | W | ? |
| no comms | X | F |
| X | no comms | F |

### 7.7.11.6 Overfill Protection Application Wiring

☛ Connect the external wiring (see illustrations below):

- Connect terminal 48 to the pump or to the valve.
- Connect terminal 49 to the mains.




### 7.7.11.7 Commissioning the Overfill Protection Application

To configure the Overfill Protection Application all essential boards needs to be configured.

#### *7.7.11.7.1 FII-DO (redundant)*

☛ Make sure all jumpers are set to **Normally Open** (N.O.). See 7.7.3.1.

*Engauge*
*SmartView*

☛ Set the [Board Instance] entity of each FII-DO board to a different value (e.g. 0 and 1).
The boards are redundant and share the same board ID, so to be able to address the board uniquely by the internal (CAN-bus) or external FlexConn protocol, the board instance must be different to distinguish the boards from each other.

☛ Set the [Counterpart Board Instance] entity of each FII-DO board to the [Board instance] of the *counterpart* FII-DO board (redundant board).

☛ Set the [Relay Mode] entity of R3 and R4 relay to <Normally Energized> for both FII-DO boards.

☛ Set the [Alarm Mode] entity of R3 and R4 relay to <PV Monitoring> for both FII-DO boards.

☛ Set the [Monitor Mode] entity of R3 and R4 relay to <Local> for both FII-DO boards.

☛ Set the [Threshold] entity and [Hysteresis] entity of R3 and R4 relay to the application-specific desired values, for both FII-DO boards **identically**.

☛ For *overfill* protection, configure the [Threshold] entity above the HA and HH setting of the TII-XR board. Entities [High alarm] and [High high alarm].

☛ For *underfill* protection, configure the [Threshold] entity below the LA and LL setting of the TII-XR board. Entities [Low alarm] and [Low low alarm].

☛ For *overfill* protection, configure the [Threshold Mode] entity of R3 and R4 relay to <Treat as HA> for both FII-DO boards.
The threshold will now be approached as high alarm above [High alarm] and [High high alarm], with the relevant hystresis behaviour.

☛ For *underfil*l protection, configure the [Threshold Mode] entity of R3 and R4 relay to <Treat as LA> for both FII-DO boards.
The threshold will now be approached as low alarm below [Low alarm] and [Low low alarm], with the relevant hysteresis behaviour.

☛ Set the other relevant entities:

The [Overfill Protection Status] entity shows the Overfill Protection Status of each FII-DO board.

<H> = Healthy

<W> = Gauge alarm (Warning)

<O> = Overfill alarm

With the [Safety shut down timer] entity, the user can set the time that a safe shutdown will be forced when only an error or failure in one relay chain is detected. Default value: <0>: Safety Shutdown Timer DISABLED.

*NOTE: This is an enhanced safety function.*

When one potential fail situation is detected in one chain, the other chain will be forced to fail safe (contacts opened) after the safety shut down time.

Philosophy: the first detected fail will not result in a shut down directly *but should be solved within a certain time*.

- If the Safety shut down timer is *enabled*, so value ≠ <0>, then operation can continue with one branch till second fault is detected.

In other words, this means: In case an anomaly is deteced by the internal gauge diagnostics, the gauge needs service within the time set by this timer.
Typical value: <72> hours.

- If the Safety shut down time is *disabled*, so value = <0>, then the customer wants to continue permanently with the other branch.

*NOTE: When the "Safety shut down timer" is active or running, the remaining time until shutdown can be inspected by reading the [Safety shut down timer left] entity.*

#### *7.7.11.7.2 TII-XR*

Engauge
SmartView

☛ Set the [Overfill Protection Function] entity to <Enabled>.

☛ Set the [First Relay Board Instance] entity of the [Board Instance] entity to the first FII-DO board.

☛ Set the [Second Relay Board Instance] entity of the [Board Instance] entity to the second FII-DO board.

The "Maximum Safe Fill" mechanism of the TII-XR should be ignored for the SmartRadar FlexLine overfill protection application.

When the "Maximum Safe Fill" level is configured lower than the Over fill Threshold, the PV status becomes BAD much earlier, and the FII-DO will open the contacts.

☛ Set the [Maximum safe fill level] entity above the [Threshold] values of the FII-DO boards when used for overfill protection.

***OR***

☛ Set the 9th switch [Compensations and features] entity to <FALSE>.

#### *7.7.11.7.3 PSX (Power Supply)*

CAUTION

*CAUTION! The Overfill Protection Application may ONLY be powered by AC mains. Only 85VAC - 240 VAC can be used for mains connected to the SmartRadar FlexLine having the Overfill Protection Application option.*

#### 7.7.11.8 Proof Testing

- By activating the command [Start Proof test] entity, the FII-DO simulates an overfill or underfill. The remainder of the SIF should work as expected (e.g. close a valve, stop a pump, generate an alarm) this should be validated.

*NOTE: This test must only be performed in a healthy situation when the product level in the tank is below the overfill threshold or above the underfill threshold.*

During the proof test - when the level is simulated above or below the threshold - the "Overfill protection status" will indicate "O" in order to enable checking the "Proof test" results in the control room as well.

Each FII-DO of the overfill protection application implements the proof test functionality, so the proof test has to be performed *successively for both modules*.

- By activating the command [Stop Proof test] entity, the FII-DO returns to normal overfill analysis mode again.

*NOTE: The FII-DO module of the SmartRadar FlexLine overfill protection safety application implements an automatic termination of the "Proof test" function in case the user forgets the command* [Stop Proof test].

*Engauge*
*SmartView*

☛Set the [Proof test termination time out] entity to the most desired value in *minutes*:

- <0> (auto termination off)
- <5> (default)
- <10>
- <20>
- <30>

## 7.8 SmartView Display Interface (FII-SMV)

### 7.8.1 Introduction

The Field Interface Instrument - SmartView (FII-SMV) board is a module that communicates with *SmartView*.

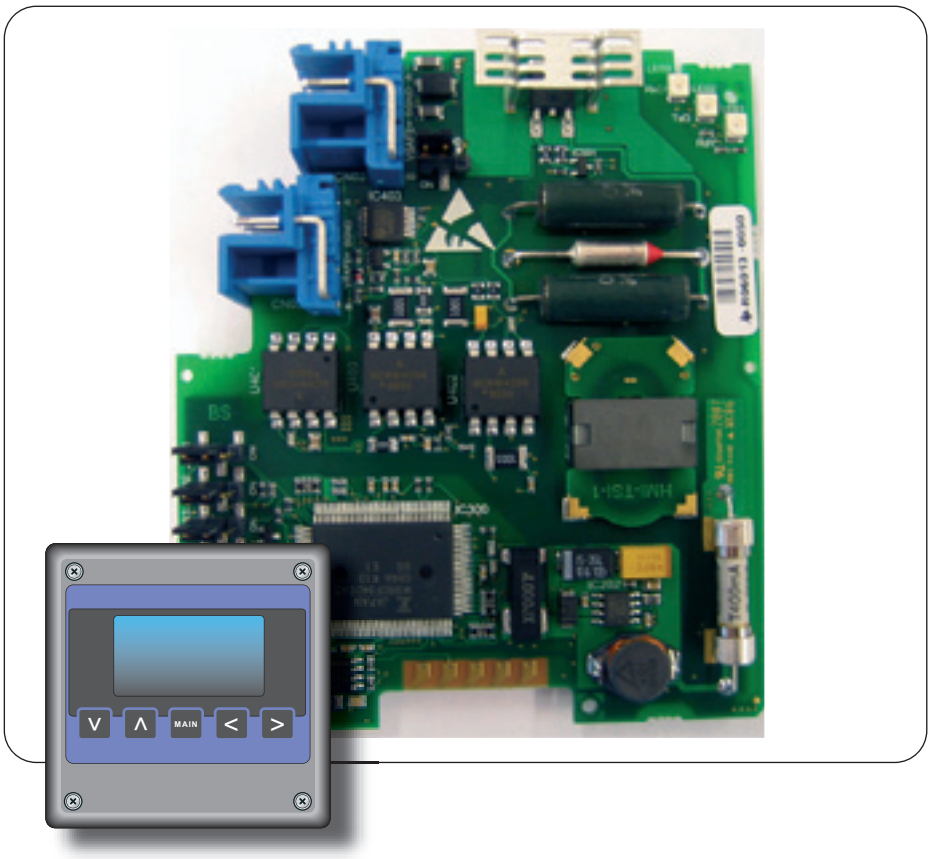



FIGURE 7-25 The FII-SMV board with the *SmartView* display F4A07-0013

At request from *SmartView* the FII-SMV board prepares data sets for it. The requests from *SmartView* depend on the actual screen at the time. The communication between the FII-SMV and *SmartView* uses an own protocol on an RS-485 physical layer.

The *SmartView* display can be delivered in 3 versions, each version having its own specific address:

- Portable *SmartView* (address 1)
- *SmartView* fixed on the instrument (address 2)
- *SmartView* as a tank-side indicator (address 3)

The FII-SMV board continuously scans all addresses, and only the one with the lowest address will be served.

So, for example, if a stand-alone SmartView (address 3) and an integrated SmartView (address 2) are connected, the stand-alone SmartView (address 3) will be served as soon as the integrated SmartView (address 2) is closed (set to idle).

### 7.8.2 Commissioning the FII-SMV

For a correct functioning of the FII-SMV module in an instrument the following entities can be set by using either *Engauge* or *SmartView*.

*Engauge*
*SmartView*

☛By using the following table, check each entity for correctness.

| Name | Value Range | Default Value | Explanation |
|---|---|---|---|
| [Decimal separator] | <point><br><comma> | <point> | The decimal separator in which entities are shown on the *SmartView* display. |
| [Tenth millimeter selection] | <enable><br><disable> | <enable> | Determines whether the tenth millimeter is shown on the display in the [PV screen] in case a level entity is shown. |
| [Identification] | 8 characters e.g.<br><TANK1234> | <--------> | Name of a tank or instrument. This string is visible within a [PV screen]. |
| [Password] | <.....> 6 characters | <ENRAF2> | The password *SmartView* uses for entering the protected level.<br>Note: Some settings reside under the protected level. |
| [Function identification] | <.....> 13 characters | <SmartView mst> | The name of the current function of this module. This name is visible on the *SmartView* display. |
| [Extra information switch] | <level temperature><br><Info Switch> | <Info Switch> | Determines whether the [extra information] screen on the *SmartView* will display level and temperature or extra information from a specific function. |
| [Extra info board ID] | <01.....XX> 2 digits | <01> | Board ID of the board that has the [extra information] to display.<br>In case of OneWireless, the ID = 12. |
| [Extra info board instance] | <00.....XX> 2 digits | <00> | Board instance of the board that has the [extra information] to display. |
| [Extra info function instance] | <01.....XX> 2 digits | <01> | Function instance that has extra information to display.<br>In case of OneWireless, this = 01. |

### 7.8.3 Reading the SmartRadar FlexLine field device information from the SmartView

**To read the SmartRadar FlexLine field device information from the SmartView**

1. On SmartView, press the UP ARROW and DOWN ARROW simultaneously (MENU push buttons) to view the menu items on the display.
2. On the display, scroll to the **commands** item using the **MENU** buttons.
3. Press the LEFT ARROW and RIGHT ARROW (**SELECT** push buttons) simultaneously. You are prompted to enter the password. The default password for SmartView is AAAAAA.
4. Use the **MENU** push buttons to enter the password and then press the SELECT push buttons. The list of **commands** appears.
5. Scroll to select the CAN-1WL FlexConn board name and then press the SELECT push buttons.
6. Scroll to select **board** and then press the **SELECT** push buttons.
7. Scroll to select **Read Dev Param** then press the **SELECT** push buttons.
8. On the display, scroll to the **commissioning** item using the **MENU** buttons.
9. Scroll to select the CAN-1WL FlexConn board name and then press the **SELECT** push buttons.

   The details available on the SmartView are as follows:

   - Board Serial No
   - Network Address
   - Device revision
   - CAN-1WL Build
   - Tx Power Level
   - Radio Mode
   - SD Card Status
   - Key Tx Status
   - Radio Diag1
   - Radio Diag2
   - Device Diag1
   - Device Diag2

## 7.9 Pressure & Density Measurement and Other HART Inputs (FCI-HT)

### 7.9.1 Introduction

The Field Communication Instrument - HART (FCI-HT) board is a HART®[1] master module that enables hybrid-signal (both analog + digital) communication between the FlexConn instrument and a HART sensor.

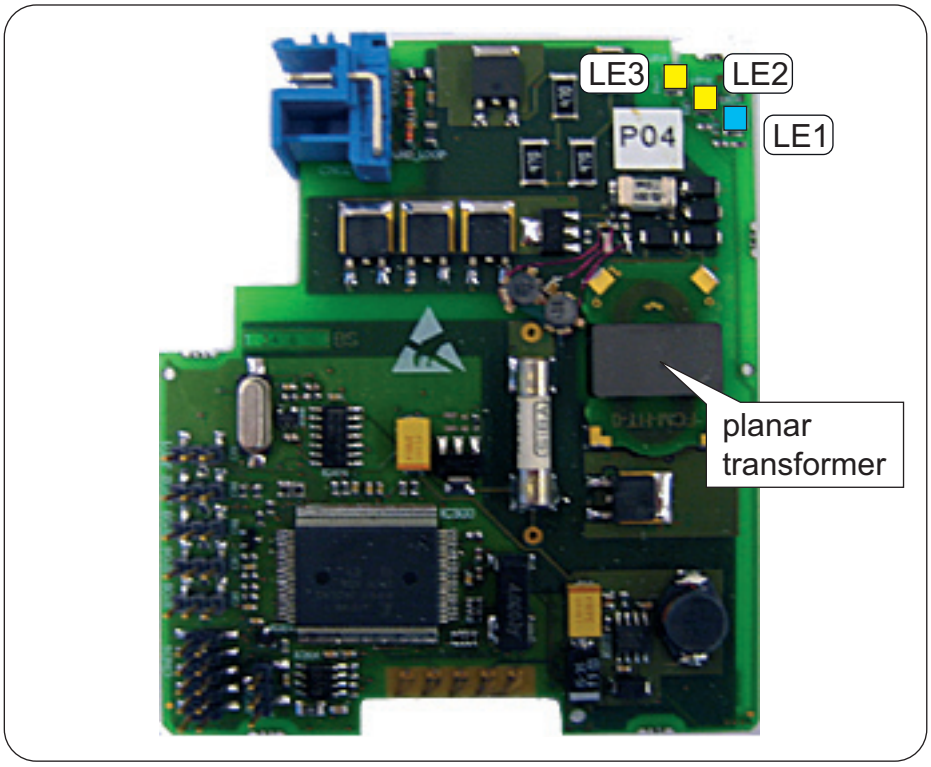



FIGURE 7-26 The FCI-HT board F4A07-0014

The HART protocol is a bi-directional master-slave communication protocol, which is used to communicate between intelligent field instruments and host systems.

The FCI-HT board has a planar transformer for galvanic isolation from the HART bus. See FIGURE 7-26.

LED LE1 is the board's [Health] LED. LEDs LE2 and LE3 will be flashing to indicate activity on the HART bus. LE2 indicates data is being transmitted (Tx), LE3 indicates data is being received (Rx).

With the HART protocol, an analog 4-20 mA signal can be combined with a digital Frequency Shift Keying (FSK) signal. See FIGURE 7-27.

1. Highway Addressable Remote Transducer.

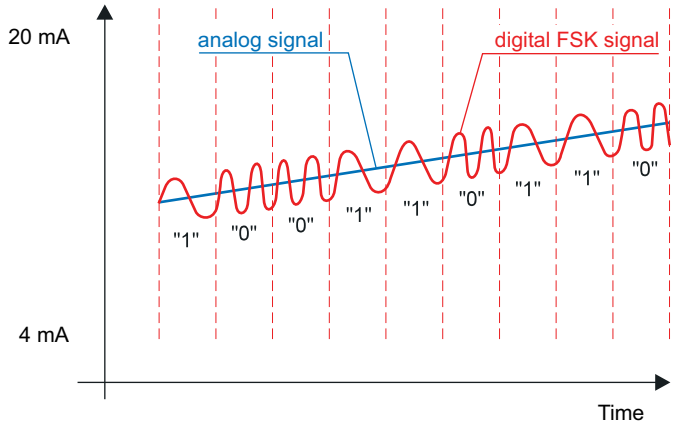



FIGURE 7-27 The analog and digital signals within the HART® communication F4A07-0015

### 7.9.2 Software Description

The FCI-HT board, being a functional module of the SmartRadar FlexLine, contains embedded software which enables it to collect data input from sensors via both the HART bus and the FlexConn CAN bus.

Moreover the FCI-HT module can calculate the HIMS[1] product density.

The *main* function of the FCI-HT software is to measure HIMS product density, by connecting the FCI-HT board via the HART bus to 1 or 2 pressure sensors, and via the FlexConn bus to a product level and a water level sensor.

To measure product density, the needed standard system configuration is:

- HART pressure sensor P1 (product pressure)
- HART pressure sensor P3 (Vapour pressure)
- Product level scanned from a FlexConn board (e.g. TII-XR)
- Water level scanned from a FlexConn board (e.g. FII-VT)

For tanks that are free venting to the atmosphere or floating-roof tanks, P3 pressure is not required. The water level sensor is also optional.

1. Hybrid Inventory Measurement System.

For HIMS density measurement system diagrams, see FIGURE 7-28 and FIGURE 7-29.

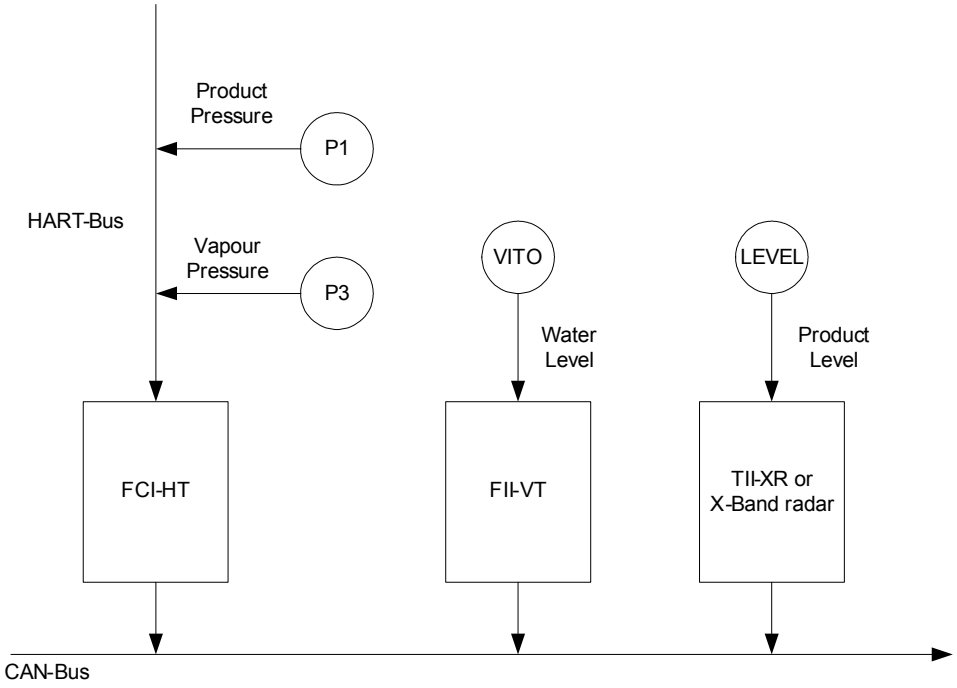



FIGURE 7-28 Standard HIMS density measurement system diagram

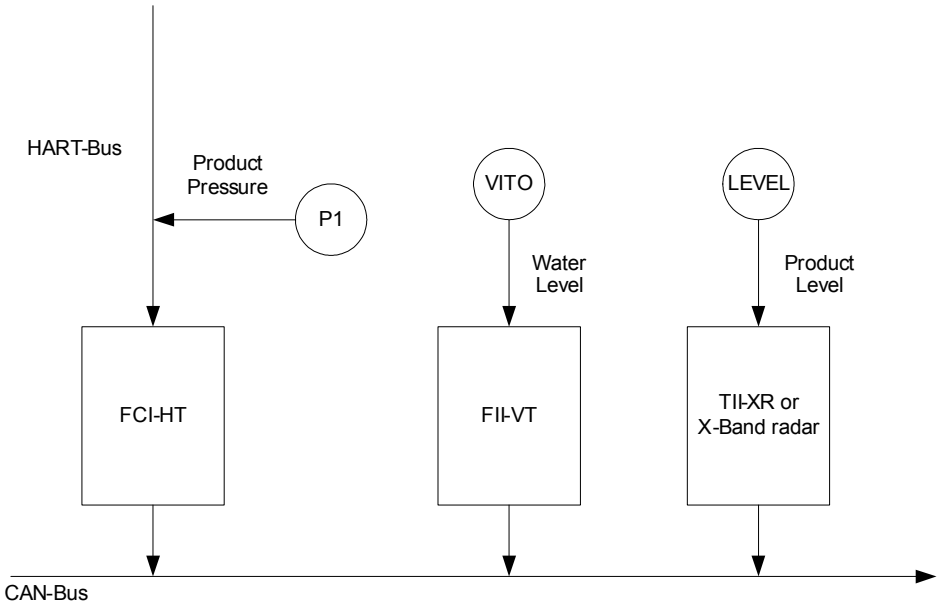



FIGURE 7-29 Floating-roof or free-venting tank HIMS density measurement system diagram

As an *alternative* function, the FCI-HT board also allows the connection of up to 5 generic HART sensors operating in *multi-drop digital* mode or one generic HART sensor operating in *analog* mode.

In the multi-drop digital mode situation, one or two of the generic HART sensors can be [P1 Pressure] or [P3 Pressure], providing product pressure and Vapour pressure respectively, but no HIMS density calculation will be available.

The HART sensors and HIMS density measurement are allocated to a function number in the FCI-HT software. See table below.

| FlexConn Function | Device Type |
|---|---|
| Function 1 | [P1 Pressure] |
| Function 2 | [P3 Pressure] |
| Function 3 | [Distance] |
| Function 4 | [Temperature] |
| Function 5 | [Pressure] |
| Function 6 | [Density] |
| Function 7 | [Other] |
| Function 8 | [HIMS Density] |

TABLE 6-1 FlexConn function allocation

Function 1 is exclusively reserved for P1 pressure, Function 2 is exclusively reserved for P3 pressure, and Function 8 is exclusively reserved for HIMS density calculation.

Only one of each type of HART device can be allocated to a function. Therefore this limits the number of HART devices of each type that can be fitted.

*Example 1*

4 HART pressure devices and 1 temperature device can be connected.

- P1 pressure device allocated to Function 1
- P3 pressure device allocated to Function 2
- one pressure device allocated to Function 5
- one pressure device allocated to Function 7
- the temperature device allocated to Function 4

*Example 2*

2 HART density devices and 1 distance device can be connected.

- density device 1 allocated to Function 6
- density device 2 allocated to Function 7
- the distance device allocated to Function 3

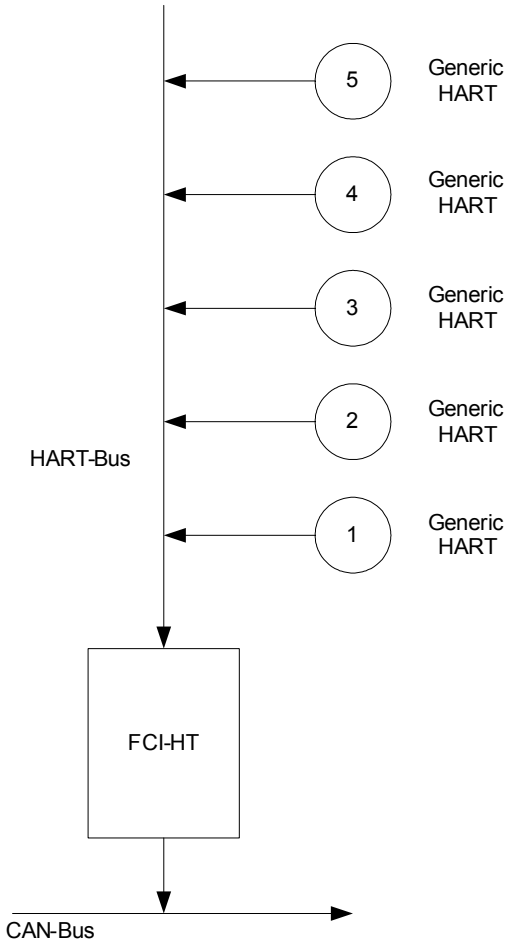



FIGURE 7-30 Alternate system diagram multi-drop digital mode

In analog mode, the connected HART device will be allocated to Function 1 through 7, depending on the type of HART device connected.

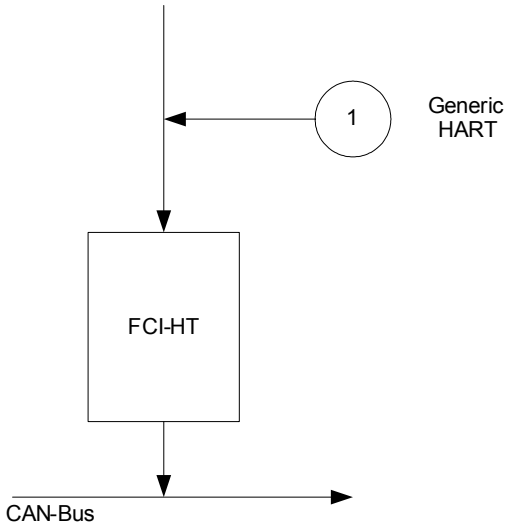



FIGURE 7-31 Analog mode system diagram

### 7.9.3 Software Specifications

#### 7.9.3.1 General

The *main* function of the FCI-HT software is to measure HIMS product density, by connecting the FCI-HT board via the HART bus to 2 pressure sensors (P1 and P3), and via the FlexConn bus to a product level sensor and an optional water level sensor.

The *alternative* function is to connect up to 5 generic HART devices operating in multi-drop digital mode, or 1 generic HART device operating in analog mode.

The FCI-HT software only supports HART devices with the following addresses.

| HART Address | Function |
|---|---|
| 00 | Reserved for HART device in analog mode |
| 01 | Reserved for P1 pressure sensor |
| 02 | N/A Reserved for future use |
| 03 | Reserved for P3 pressure sensor |
| 04 | HART generic sensor |

| HART Address | Function |
|---|---|
| 05 | HART generic sensor |
| 06 | HART generic sensor |
| 07 | HART generic sensor |
| 08 | HART generic sensor |
| 09 | HART generic sensor |
| 10 | HART generic sensor |
| 11 | HART generic sensor |
| 12 | HART generic sensor |
| 13 | HART generic sensor |
| 14 | HART generic sensor |
| 15 | HART generic sensor |

TABLE 6-2 Accepted HART addresses

Engauge SmartView

☛Before proceeding with commissioning, first check the maximum start-up current of all connected HART devices.

☛Make sure the HART address of the installed device(s) are in accordance with TABLE 6-2.

#### 7.9.3.2 P1 Pressure

The FCI-HT software only accepts the Primary Value of a P1 pressure HART device in SI units kilo Pascals (kPa).

Engauge SmartView

☛Make sure the P1 pressure HART device is configured to output data in kilo Pascals (kPa). If not, correctly configure as yet, by using an appropriate HART configuration tool.

| Sensor Type | Accepted HART PV Unit | Abbreviation | HART PV Unit Code |
|---|---|---|---|
| P1 Pressure | Kilo Pascal | kPa | 12 |

TABLE 6-3 Accepted PV unit for a P1 HART device

*NOTE: The Secondary and Tertiary values of a P1 pressure HART device may be any units.*

The PV of the P1 pressure HART device is read and converted into SI Units Pascals (Pa) within the FlexConn function PV.

The value is filtered, and the filtering factor depends on the value set in the entity [P1 Integration time]. A higher value gives more filtering, and a lower value gives less filtering.

The correction factor stored in the [P1 PV offset] entity is then subtracted from the filtered value. If the [P1 PV offset] entity = 0 no offset is applied.

Depending on the [PV selected type] entity, the P1 pressure can be displayed as either absolute pressure or relative pressure.

| PV Unit Type | Display Unit Type | PV selected type |
|---|---|---|
| P1 Pressure | Absolute | 1 |
| | Relative | 2 |

TABLE 6-4 P1 pressure displayed unit types

If Relative pressure is selected, the value stored in the [Ambient Air Pressure] entity is added to the measured pressure. If Absolute pressure is selected, no factor is added. The final result is available in the [Primary Value] entity.

*NOTE: Absolute pressure is used in the density calculation; the relative pressure is only displayed in P1* [Primary Value].

For the FCI-HT software to differentiate between a HART device malfunction and a HART device not actually installed, P1 pressure has the entity [P1 Installed] which must be set to either <Installed> if a P1 pressure HART device is actually fitted or <Not Installed> if a P1 pressure HART device is *not* actually fitted.

The Secondary and Tertiary values of a P1 pressure HART device are not converted, and they are simply translated from the HART device to the FlexConn environment.

#### 7.9.3.3 P3 Pressure

The FCI-HT software only accepts the Primary Value of a P3 pressure HART device in SI units kilo Pascals (kPa).

Engauge SmartView

☛ Make sure the P3 pressure HART device is configured to output data in kilo Pascals (kPa). If not, correctly configure as yet, by using an appropriate HART configuration tool.

| Sensor Type | Accepted HART PV Unit | Abbreviation | HART PV Unit Code |
|---|---|---|---|
| P3 Pressure | Kilo Pascal | kPa | 12 |

TABLE 6-5 Accepted PV unit for a P3 HART device

*NOTE: The Secondary and Tertiary values of a P3 pressure HART device may be any units.*

The PV of the P3 pressure HART device is read and converted into SI Units Pascals (Pa) within the FlexConn function PV.

The value is filtered, and the filtering factor depends on the value set in the entity [P3 Integration time]. A higher value gives more filtering, and a lower value gives less filtering.

The correction factor stored in the [P3 PV offset] entity is then subtracted from the filtered value. If the [P3 PV offset] entity = 0 no offset is applied.

Depending on the [PV selected type] entity, the P3 pressure can be displayed as either absolute pressure or relative pressure.

| PV Unit Type | Display Unit Type | PV selected type |
|---|---|---|
| P3 Pressure | Absolute | 1 |
| | Relative | 2 |

TABLE 6-6 P3 pressure displayed unit types

If Relative pressure is selected, the value stored in the [Ambient Air Pressure] entity is added to the measured pressure. If Absolute pressure is selected, no factor is added. The final result is available in the [Primary Value] entity.

NOTE: *Absolute pressure is used in the density calculation; the relative pressure is only displayed in P3* [Primary Value].

For the FCI-HT software to differentiate between a HART device malfunction and a HART device not actually installed, P3 pressure has the entity [P3 Installed] which must be set to either <Installed> if a P3 pressure HART device is actually fitted or <Not Installed> if a P3 pressure HART device is *not* actually fitted. For example, in the case of free-venting tanks, P3 would usually not be installed.

If the P3 pressure status is <Good Actual>, the P3 pressure value is also stored in memory in the [Last Valid P3] entity, to allow recovery from a power-down situation when a P3 pressure is not available.

If the measured P3 pressure is *invalid* (e.g. HART scan error), the software will check the [P3 Installed] entity to determine if P3 is actually fitted. If P3 is fitted, the software will check for a [Manual P3 Pressure] entity value to be entered. If no manual P3 pressure value is entered, the [Last Valid P3] is used in the density calculation. If no [Last Valid P3] is available, an error will be reported.

If P3 pressure is *not* installed - in the case of free-venting tanks - a default value of 0.0 for P3 pressure is used for density calculations.

The Secondary and Tertiary values of a P3 pressure HART device are not converted, and they are simply translated from the HART device to the FlexConn environment.

#### 7.9.3.4 HIMS Density

To make HIMS density calculation possible, the relevant entity values must be available. See also FIGURE 7-32.

☛ Read also the *Instruction Manual HIMS pressure measurement*.

Engauge SmartView

☛ Enter the appropriate values into the following entities:

- [Distance P1 to Zero Level]
- [Distance P3 to Zero Level]
- [Hydrostatic Deformation Level]
- [Hydrostatic Deformation Factor]
- [Local Gravity]
- [Minimum HIMS Level]
- [HIMS Level Hysteresis]
- [Ambient Air Density]
- [Tank Vapour Density]

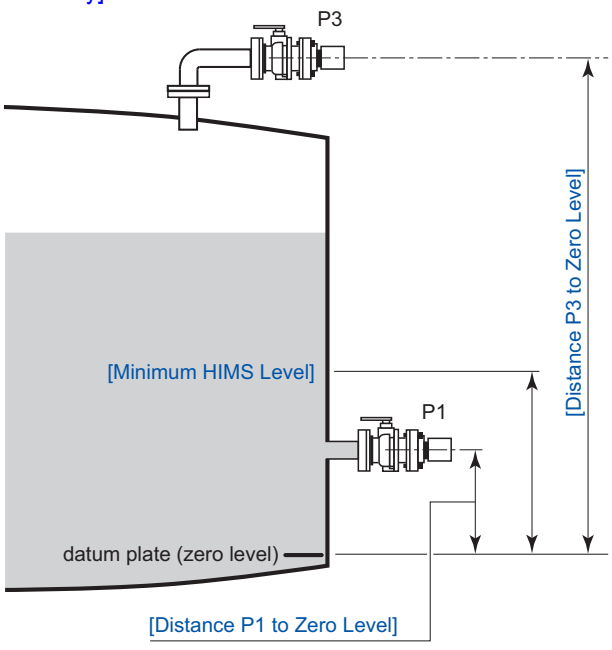



FIGURE 7-32 HIMS configuration principle

To calculate HIMS density, the following valid data must be available:

- P1 pressure
- P3 pressure
- Product level
- Water level (optional)

The software analyses the status of these 4 (3) inputs, to determine the value and status of the [HIMS Density PV].

If the HIMS Density PV status is <Good Actual>, the HIMS Density PV value is also stored in memory in the [Last Valid Density] entity, to allow recovery from a power-down situation when a HIMS Density PV value is not available.

If any of the 4 input statuses are bad, the software will check for a [Manual Product Density] entity value to be entered. If a [Manual Product Density] entity value is entered, this value will be used for the HIMS Density PV. If no [Manual Product Density] entity value is entered, the software will check if a [Last Valid Product Density] entity value was stored. If a [Last Valid Product Density] entity value was stored, this value will be used for the HIMS Density PV. If no [Manual Product Density] or [Last Valid Product Density] entity value is found, an error will be reported.

When calculating HIMS Density, the software will check for a negative density value. If the value is negative, the same manual or last-valid mechanism is used as described before. If the value is positive, HIMS Density is calculated.

When calculating HIMS Density, in order to achieve a valid result, the software will also check if the product level is above the [Minimum HIMS Level] entity value. If this condition is <True>, HIMS Density is calculated. If the product level is below the [Minimum HIMS Level] entity value, the same manual or last valid mechanism is used as described before.

When calculating HIMS Density, if the [Water Level Correction] entity is <Enabled>, the software will check if the scanned water level <= [Distance P1 to Zero Level]. If this is <True>, the HIMS Density is calculated. If the water level > [Distance P1 to Zero Level], the same manual or last valid mechanism is used as described before. If [Water Level Correction] entity is <Disabled>, the software will not check the scanned water level.

#### 7.9.3.5 Generic HART Devices

The FCI-HT software only accepts Generic HART devices at addresses 0 and 4 through 15 with the required sensor type configured.

The generic HART devices are scanned sequentially from address 0 and then address 4 through 15. When a device is detected, initially the HART PV unit code is checked against TABLE 6-7 in the following order: Distance, Temperature, Pressure, and Density.

| Sensor Type | Accepted HART Units | Abbreviation | HART Unit Code |
|---|---|---|---|
| Pressure | Pounds per square inch | psi | 6 |
| | Pascal | Pa | 11 |
| | Kilo Pascal | kPa | 12 |

| Sensor Type | Accepted HART Units | Abbreviation | HART Unit Code |
|---|---|---|---|
| Temperature | Degrees Celsius | °C | 32 |
| | Degrees Fahrenheit | °F | 33 |
| Distance | Feet | ft | 44 |
| | Meters | m | 45 |
| | Inches | in | 47 |
| Density | Kilograms per cubic meter | $kg/m^3$ | 92 |
| | Pounds per cubic foot | $lb/ft^3$ | 94 |
| | Degrees API | API | 104 |

TABLE 6-7 Accepted units for generic HART devices

- If an accepted HART PV unit code is found, the HART device is allocated to the relevant FlexConn function as detailed in TABLE 6-8.
- If the HART PV unit code is *not* accepted, the HART SV unit code is checked against TABLE 6-7 in the following order: Distance, Temperature, Pressure, and Density. If an accepted HART SV unit code is found, the HART device is allocated to the relevant FlexConn function as detailed in TABLE 6-8.
- The process is repeated for the HART TV unit code.
- If none of the unit codes are accepted, the device is allocated to Function 7.

Engauge / SmartView

☛ If a generic HART device output is *not* in the accepted units, configure it to accepted units output data, by using the HART configuration tool.

| FlexConn Function | Device Type |
|---|---|
| Function 1 | [P1 Pressure] |
| Function 2 | [P3 Pressure] |
| Function 3 | [Distance] |
| Function 4 | [Temperature] |
| Function 5 | [Pressure] |
| Function 6 | [Density] |
| Function 7 | [Other] |
| Function 8 | [HIMS Density] |

TABLE 6-8 FlexConn function allocation

Once a device has been allocated to a function, the HART PV, SV, and TV are translated into the FlexConn function's PV, SV, and TV.

The required sensor value of the generic HART device may not be in the HART PV but it is translated into the FlexConn PV.

*Example:*

A HART temperature sensor may have a PV unit code Ohms, and a SV unit code Celsius. The required sensor value is temperature in Celsius, and this is translated into the FlexConn PV, and the Ohms value is translated into the FlexConn SV.

Translation is performed in the order: PV (Distance, Temperature, Pressure, and Density), SV (Distance, Temperature, Pressure, and Density), TV (Distance, Temperature, Pressure, and Density).

The required sensor value read from the generic HART devices will be converted into SI Units within the FlexConn PV as shown in TABLE 6-9.

The other sensor values of a generic HART device are not converted, and they are simply translated from the HART device environment into the FlexConn environment SV and TV.

| Accepted HART Units | Abbreviation | FlexConn PV Unit Translation | Abbreviation |
|---|---|---|---|
| Pounds per square inch | psi | Pascal | Pa |
| Pascal | Pa | | |
| Kilo Pascal | kPa | | |
| Degrees Celsius | °C | Celsius | °C |
| Degrees Fahrenheit | °F | | |
| Feet | ft | Meters | m |
| Meters | m | | |
| Inches | in | | |
| Kilograms per cubic meter | $kg/m^3$ | Kilograms per cubic meter | $kg/m^3$ |
| Pounds per cubic foot | $lb/ft^3$ | | |
| Degrees API | API | | |

TABLE 6-9 Generic HART device units into FlexConn PV unit translation

#### 7.9.3.6 Function Identification

Functions 1 through 8 are identified by the entities: [Function Category], [Function Type], and [Function Sub-type].

Their default identification information is detailed in TABLE 6-10.

| Function | Allocation | Function Category | Function Type | Function Sub-type |
|---|---|---|---|---|
| Function 1 | P1 Pressure | Sensor (1) | Product pressure (5) | (6) |
| Function 2 | P3 Pressure | Sensor (1) | Vapour pressure (13) | (7) |
| Function 3 | Distance | Sensor (1) | HART transmitter (12) | (16) |

| Function | Allocation | Function Category | Function Type | Function Sub-type |
|---|---|---|---|---|
| Function 4 | Temperature | Sensor (1) | HART transmitter (12) | (16) |
| Function 5 | Pressure | Sensor (1) | HART transmitter (12) | (16) |
| Function 6 | Density | Sensor (1) | HART transmitter (12) | (16) |
| Function 7 | Other | Sensor (1) | HART transmitter (12) | (16) |
| Function 8 | HIMS Density | Sensor (1) | Product density (6) | (8) |

TABLE 6-10 Default function category, type, and sub-type

The function type entity for Functions 3 through 7 can be changed from the default value <HART transmitter> to provide more information about the sensor, by setting the [User function type] entity and then resetting the FCI-HT board.

The possible values are detailed in TABLE 6-11.

| Function | Allocation | User Function Type | Value |
|---|---|---|---|
| Function 3 | Distance | User function type product level | 4 |
| | | User function type water level | 9 |
| Function 4 | Temperature | User function type product temperature | 8 |
| | | User function type Vapour temperature | 7 |
| Function 5 | Pressure | User function type product pressure | 5 |
| | | User function type Vapour pressure | 13 |
| Function 6 | Density | User function type product density | 6 |
| Function 7 | Other | User function type product level | 4 |
| | | User function type water level | 9 |
| | | User function type product temperature | 8 |
| | | User function type Vapour temperature | 7 |
| | | User function type product pressure | 5 |
| | | User function type Vapour pressure | 13 |
| | | User function type product density | 6 |

TABLE 6-11 Generic HART user function types

Functions 1 through 8 have fixed values for [PV Unit Type] and [Function Identification] entities, as detailed in TABLE 6-12.

| Function | Allocation | PV Unit Type | Function Identification |
|---|---|---|---|
| Function 1 | P1 Pressure | UNIT_TYPE_PRESSURE | <P1 Pressure> |
| Function 2 | P3 Pressure | UNIT_TYPE_PRESSURE | <P3 Pressure> |
| Function 3 | Distance | UNIT_TYPE_LENGTH | <Distance> |
| Function 4 | Temperature | UNIT_TYPE_TEMPERATURE | <Temperature> |
| Function 5 | Pressure | UNIT_TYPE_PRESSURE | <Pressure> |
| Function 6 | Density | UNIT_TYPE_DENSITY | <Density> |
| Function 7 | Other | UNIT_TYPE_UNDEFINED | <Other Units> |
| Function 8 | HIMS Density | UNIT_TYPE_DENSITY | <HIMS Density> |

TABLE 6-12 PV unit type and function identification

#### 7.9.3.7 SmartView Display

Although the Primary Values (PV) of functions 1 through 8 are *calculated* in SI units, the *SmartView display* supports the following units for local calibration, commissioning etc. The displayed unit depends on the value of the [PV selected unit] entity.

| PV Unit Type | Display Unit Type | Displayed Units | PV Selected Unit | Range |
|---|---|---|---|---|
| Pressure | Pascal | <pas> | 1 | max. 0.99 MPa |
| | Kilo Pascal | <kpas> | 2 | max. 9.9 MPa |
| | Pounds per square inch (small) | <psi s> | 3 | max. 99 psi |
| | Pounds per square inch (large) | <psi l> | 4 | max. 999 psi |
| Temperature | Degrees Celsius | <°C> | 1 | - |
| | Degrees Fahrenheit | <°F> | 2 | - |
| Distance | Meters | <m> | 1 | - |
| | Feet | <ft> | 2 | - |
| | Inches | <in> | 3 | - |
| | Fractions (feet, inches, $1/16^{th}$ inch) | <f.i.s.> | 4 | - |
| Density | Kilograms per cubic meter | <kg/m3> | 1 | - |
| | Pounds per cubic foot | <lb/f3> | 2 | - |
| | Degrees API | <a.p.i> | 3 | - |

| PV Unit Type | Display Unit Type | Displayed Units | PV Selected Unit | Range |
|---|---|---|---|---|
| Other | Milli | <m ...> | 1 | - |
| | (none) | <-> | 2 | - |
| | Kilo | <k ...> | 3 | - |
| | Mega | <M ...> | 4 | - |

TABLE 6-13 *SmartView* displayed unit types

The following PV types are supported on the *SmartView* display for P1 pressure and P3 pressure only. These are available changed by setting the [PV selected type] entity. This is detailed in TABLE 6-14.

| PV Unit Type | Display Unit Type | Displayed Type | PV selected type |
|---|---|---|---|
| P1 Pressure | Absolute | <ABS> | 1 |
| P3 Pressure | Relative | <REL> | 2 |

TABLE 6-14 P1 and P3 pressure displayed unit types

### 7.9.4 Board Commissioning

The commissioning entity for each *function* is initially default to <False>. The commissioning entity for each function will only be <True> when the associated entities of each function have been set *within normal operating range*.

The *board-level* commissioned entity default is also <False>. It will only be <True> when all the function-level commissioned entities are <True>.

#### 7.9.4.1 Function 1 Commissioning

*Engauge*
*SmartView*

☛ Set all Function 1 entities according to TABLE 6-15 requirements, to commission P1.

| HIMS Density | P1 Pressure Sensor Detected | P1 Ambient Air Pressure and P1 Installed | Commissioned |
|---|---|---|---|
| <Enabled> | N/A | [P1 ambient air pressure] ≠ <default><br>AND<br>[P1 installed] = <enable> | <True> |
| | | [P1 ambient air pressure] = <default><br>OR<br>[P1 installed]= <disable> | <False> |

| HIMS Density | P1 Pressure Sensor Detected | P1 Ambient Air Pressure and P1 Installed | Commissioned |
|---|---|---|---|
| <Disabled> | Yes | [P1 ambient air pressure] ≠ <default><br>AND<br>[P1 installed] = <enable> | <True> |
| | | [P1 ambient air pressure] = <default><br>OR<br>[P1 installed] = <disable> | <False> |
| | No | N/A | <True> |

TABLE 6-15 Function 1 commissioning entities

#### 7.9.4.2 Function 2 Commissioning

Engauge SmartView

☛Set all Function 2 entities according to TABLE 6-16 requirements, to commission P3.

| HIMS Density | P3 Pressure Sensor Detected | P3 Installed | P3 Ambient Air Pressure | Commissioned |
|---|---|---|---|---|
| <Enabled> | Yes | <Enable> | [P3 ambient air pressure] ≠ <default> | <True> |
| | | | [P3 ambient air pressure] = <default> | <False> |
| | | <Disable> | N/A | <False> |
| | No | <Enable> | N/A | <False> |
| | | <Disable> | | <True> |
| <Disabled> | Yes | <Enable> | [P3 ambient air pressure] ≠ <default> | <True> |
| | | <Disable> | [P3 ambient air pressure] ≠ <default> | <False> |
| | | N/A | [P3 ambient air pressure] = <default> | <False> |
| | No | N/A | N/A | <True> |

TABLE 6-16 Function 2 commissioning entities

#### 7.9.4.3 Function 3 through 7 Commissioning

Engauge SmartView

☛Set all Function 3 through 7 entities according to TABLE 6-17 requirements, to commission all generic HART sensors.

| Function | HART Sensor Detected | User Function Type | Commissioned |
|---|---|---|---|
| 3 | Yes | = <Product level> OR <Water level> | <True> |
| | | ≠ <Product level> OR <Water level> | <False> |
| | No | N/A | <True> |
| 4 | Yes | = <Product temp.> OR <Vapour temp.> | <True> |
| | | ≠ <Product temp.> OR <Vapour temp.> | <False> |
| | No | N/A | <True> |
| 5 | N/A | N/A | <True> |
| 6 | N/A | N/A | <True> |
| 7 | N/A | N/A | <True> |

TABLE 6-17 Function 3 through 7 commissioning entities

#### 7.9.4.4 Function 8 Commissioning

Engauge
SmartView

☛Set Function 8 entities according to TABLE 6-18 requirements, to commission the HIMS density function.

| HIMS Density | Function 8 Commissioning Entities | Commissioned |
|---|---|---|
| Enabled | <Hydrostatic deformation level> ≠ <Default><br>AND<br><Hydrostatic deformation factor> ≠ <Default><br>AND<br><Local gravity> ≠ <Default><br>AND<br><Minimum HIMS level> ≠ <Default><br>AND<br><Ambient air density> ≠ <Default><br>AND<br><Tank Vapour density> ≠ <Default><br>AND<br><Distance P1 to zero level> ≠ <Default><br>AND<br><Distance P3 to zero level> ≠ <Default> | <True> |
| | <Hydrostatic deformation level> = <Default><br>OR<br><Hydrostatic deformation factor> = <Default><br>OR<br><Local gravity> = <Default><br>OR<br><Minimum HIMS level> = <Default><br>OR<br><Ambient air density> = <Default><br>OR<br><Tank Vapour density> = <Default><br>OR<br><Distance P1 to zero level> = <Default><br>OR<br><Distance P3 to zero level> = <Default> | <False> |
| Disabled | N/A | <True> |

TABLE 6-18 Function 8 commissioning entities

### 7.9.5 Hardware Configuration

#### 7.9.5.1 Terminal Allocation

| Terminal Number | Name | Function |
|---|---|---|
| 24 | V_Loop | HART Bus power |
| 25 | GND_Loop | HART Bus ground |

#### 7.9.5.2 LED Allocation

| LED Number | Function |
|---|---|
| LE2 | HART data Transmit |
| LE3 | HART data Receive |

## 7.10 HART Analog Outputs (HCI-HAO)

### 7.10.1 Introduction

The Host Communication Interface – HART Analog Output (HCI-HAO) is a HART® slave module which communicates with the associated HART master over the HART bus.

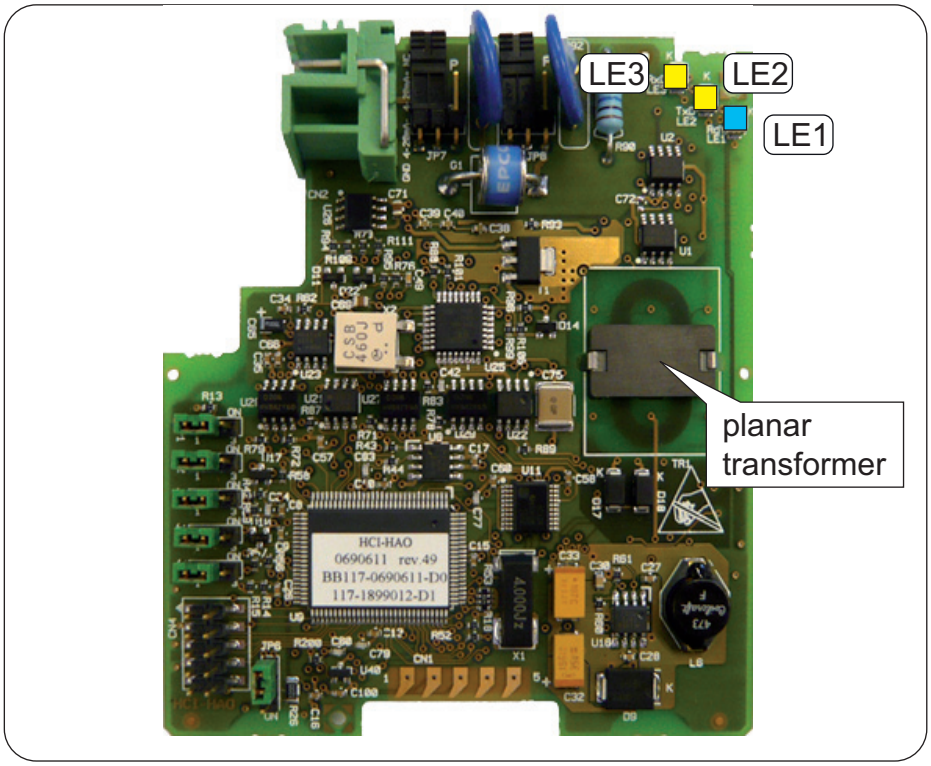



FIGURE 7-33 The HCI-HAO board

F4A09-0005

The HART protocol is a bi-directional master-slave communication protocol, which is used to communicate between intelligent field instruments and host systems.

The HCI-HAO board has a planar transformer for galvanic isolation from the HART bus. See FIGURE 7-33.

LED LE1 is the board's [Health] LED. LEDs LE2 and LE3 will be flashing to indicate activity on the HART bus. LE2 indicates data is being transmitted (Tx), LE3 indicates data is being received (Rx).

### 7.10.2 Functional Description

HCI-HAO is a HART slave module, which uses standard HART communication to communicate with HART-devices. This module makes use of the Bell 202 Frequency Shift Keying (FSK) standard to superimpose digital signals at a low level on the 4–20 mA analog signal.

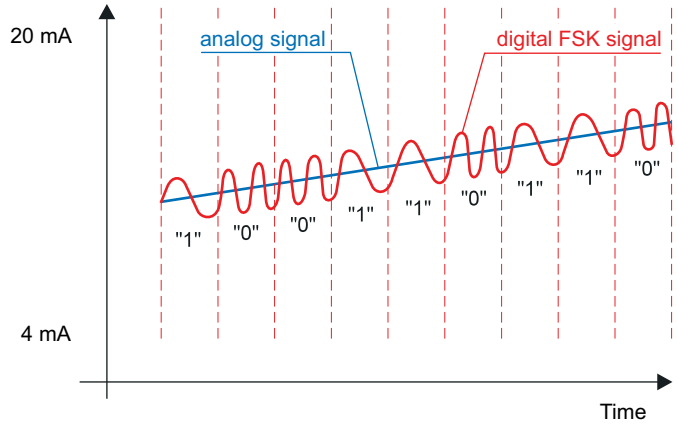



FIGURE 7-34 The analog and digital signals within the HART® communication F4A07-0015

The HCI-HAO works as an interface board between FlexConn boards and a HART master, and it makes the data available on the HART bus.

The user needs *to set the required linked variable details*.

The linked primary variable is mapped between 4–20 mA on the analog output depending on the range values set. The linked variables are scanned every 1 second and so is the analog output refresh rate.

The HCI-HAO is configurable by:

- a HART communicator
- a local SmartView
- Engauge

The HCI-HAO (board ID = 11) has following two functions:

| Function | Category | Type | Sub-type |
|---|---|---|---|
| 1 - HART communication | Communication | Instrument slave | HART |
| 2 - Analog output | Sensor | Analog output | 4 - 20 mA |

All the HART *universal commands* and some *common practice commands* are supported by HCI-HAO. These are listed in the below tables.

| HART Universal Ccommands | |
|---|---|
| **Command no.** | **Description** |
| 0 | Read Unique Identifier |
| 1 | Read Primary Variable |
| 2 | Read Loop Current and Percentage of Range |
| 3 | Read Dynamic variables and Loop Current |
| 4 | Reserved |
| 5 | Reserved |
| 6 | Write Polling Address |
| 7 | Read Loop Configuration |
| 8 | Read Dynamic Variable Classifications |
| 9 | Read Device Variable With Status |
| 10 | Reserved |
| 11 | Read Unique Identifier Associated with Tag |
| 12 | Read Message |
| 13 | Read Tag, Descriptor, Date |
| 14 | Read PV Sensor Information |
| 15 | Read Device Information |
| 16 | Read Final Assembly Number |
| 17 | Write Message |
| 18 | Write Tag, Descriptor, Date |
| 19 | Write Final Assembly Number |
| 20 | Read Long Tag |
| 21 | Read Unique Identifier Associated With Long Tag |
| 22 | Write Long Tag |

| HART Common Practice Commands | |
|---|---|
| **Command no.** | **Description** |
| 34 | Write Primary Variable Damping Value |
| 35 | Write Primary Variable Range Values |
| 36 | Set Primary Variable Upper Range Value |
| 37 | Set Primary Variable Lower Range Value |
| 38 | Reset Configuration Changed Flags |
| 40 | Enter / Exit Fixed Current Mode |
| 41 | Perform Self Test |
| 42 | Perform Device Reset |
| 44 | Write Primary Variable Units |
| 48 | Read Additional Device Status |
| 50 | Read Dynamic Variable Assignments |
| 51 | Write Dynamic Variable Assignments |
| 53 | Write Device Variable Units |
| 54 | Read Device Variable Information |
| 55 | Write Device Variable Damping Value |
| 59 | Write Number Of Response Preambles |
| 72 | Squawk |
| 79 | Write Device Variable |
| 113 | Catch Device Variable |

### 7.10.3 Other HCI-HAO features

- *Planar transformer* for galvanic isolation from HART bus.
- *Malfunctioning* of the HCI-HAO card (or any linked cards) is reveiled on the HART bus by means of the *device status*.
- If any *fatal errors* occur during operation - which will run the program into an undesired situation - then a software reset (Warm Reset) is given to the HCI-HAO software. During this situation, the output of the module remains at the desired level till the software starts normal working. Handling of a fatal error is a general FlexConn function. This will update the appropriate entity as well.
- *Unit conversions* for the linked variables are possible. All the linked variables available through linking (data read from other FlexConn boards) are in SI units. Accepted units are listed in the table below.

| Sensor Type | Accepted HART Units | Abbreviation | HART Unit Code |
|---|---|---|---|
| Temperature | Degrees Celsius | °C | 32 |
| | Degrees Fahrenheit | °F | 33 |
| Pressure | Pounds per square inch | psi | 6 |
| | Pascal | Pa | 11 |
| | Kilo Pascal | kPa | 12 |
| Level | Feet | ft | 44 |
| | Meters | m | 45 |
| | Inches | in | 47 |
| Density | Kilograms per cubic meter | $kg/m^3$ | 92 |
| | Pounds per cubic foot | $lb/ft^3$ | 94 |
| | Degrees API | API | 104 |

- *Analog output read back* mechanism, which is used to indicate any errors in the analog output section. An error can be indicated using the control relay on the FII-DO module over the CAN bus. If some error is found in the DAC read back, then the same is updated in function 2 (sensor) health, as per following details in status and status codes:

| | |
|---|---|
| Status | <BAD> |
| Status Category | <GENERAL_HARDWARE_FAIL> |
| Status Code | <DAC_READ-BACK_FAIL> |

- *Active and Passive mode* of operation for Loop current.
- *Multi-drop mode* supported to connect more than one HART-compatible device on HART bus. For operating the device in Multi-Drop mode, user needs to select the polling address to a non-zero value. Making the polling address to a non-zero value makes the output current mode to Fixed_4_20_MA (4 mA fixed). Non-zero polling address will automatically make the output current mode to Fixed_4_20_MA.

All the HART-compatible devices connected over the HART bus must have different polling addresses. *Multi-drop mode is supported only in Passive mode of loop configuration*. When the output current mode is set to Standard_4_20_MA, the polling address of the device must be made zero.

- When the device is *not* in multi-drop mode (STANDARD_4_20_MA mode selected) then the output current follows the changes in linked PV value.
- *Scanning of each linked available PV, SV, TV and QV on the CAN-bus with frequency of 1 Hz.* That means all the available linked variables are scanned every 1 second.
- The *analog output is refreshed every 1 second*, even if there is no change in the scanned variables. So, the watchdog for analog output is automatically implemented. If the output is not refreshed within 45 seconds then a watchdog to analog output is generated and the output is forced to 0 mA.
- *During startup, the analog output* of the HCI-HAO module is *kept low (< 0.5 mA)*. This value will be there till initialization takes place. Once the normal operation starts the output will follow the linked PV depending upon the output mode setting.
- *Manual overwrite mechanism*. This is a standard FlexConn functionality. Separate configuration and command entities are defined for this. See 7.10.5 - Board Commissioning.

### 7.10.4 Calibration of the HCI-HAO

A calibration provision is given, which is used to accurately map the analog output between 4 -20 mA using the two range values entered for Primary Variable.

Following table lists all entities required for calibration.

| Entity | Data Type | Type |
|---|---|---|
| [Analog Output at 4 mA] | Float | non-volatile R/W |
| [Analog Output at 18 mA] | Float | non-volatile R/W |
| [Calibrate at 4 mA] | Undefined | command |
| [Calibrate at 18 mA] | Undefined | command |
| [Enter Calibration Mode] | Undefined | command |
| [Exit Calibration Mode] | Undefined | command |

*NOTE: Commands used in the following calibration procedure can be executed either by using the CAN tool, the SmartView, or Engauge.*

Calibrate the analog output of the HCI-HAO as follows:

☛Connect loop resistor at connector CN2

☛Power up HCI-HAO board

☛ Give command [Enter Calibration Mode]

☛ Give command [Calibrate Analog Output at 4mA]

☛ Measure actual output current through the loop resistor, using a current meter

☛ Enter this value in the [Analog Output at 4mA] entity

☛ Give command [Calibrate Analog Output at 18mA]

☛ Measure actual output current through the loop resistor, using a current meter

☛ Enter this value in the [Analog Output at 18mA] entity

☛ Give command [Exit Calibration Mode], to exit the calibration mode

These calibration data are used to calculate the analog output current for the Primary Value (PV).

Untill calibration has been carried out, the Health status of the PV and the analog output function will be:

| | |
|---|---|
| Status | <BAD> |
| Status Category | <STATUS_CATEGORY_BAD_GENERAL_CALIBRATION_FAIL> |
| Status Code | <CALIBRATION_SET_POINTS_NOT_CALIBRATED> |

### 7.10.5 Board Commissioning

#### 7.10.5.1 Basic Configurable Entities Overview

Basic configuration entities of the HCI-HAO board, which are configurable by using *SmartView*, are listed in the following table.

| Entity | SmartView Display | Data Type | Type | Default | Function |
|---|---|---|---|---|---|
| [PV Link board ID] | PV linked Brd ID | Unsigned int 8 bits | Non-Volatile | <0> | Board Specific |
| [PV Link board instance] | PV linked Brd IN | Unsigned int 8 bits | Non-Volatile | <0> | |
| [PV Link function instance] | PV linked Brd FI | Unsigned int 8 bits | Non-Volatile | <0> | |
| [PV Link Board Sensor Value] | PV link Brd SVAL | Enumeration | Non-Volatile | <PV_LINK> | |
| [SV Link board ID] | SV linked Brd ID | Unsigned int 8 bits | Non-Volatile | <0> | |
| [SV Link board instance] | SV linked Brd IN | Unsigned int 8 bits | Non-Volatile | <0> | |
| [SV Link function instance] | SV linked Brd FI | Unsigned int 8 bits | Non-Volatile | <0> | |
| [Polling Address] | Polling Address | Unsigned int 8 bits | Non-Volatile | <0> | Communication |
| [HART PV unit code] | PV Unit Code | Enumeration | Non-Volatile | <UNKNOWN> | |
| [Upper Transducer Limit] | Upper Tran Limit | Float | Non-Volatile | <0> | |
| [Lower Transducer Limit] | Lower Tran Limit | Float | Non-Volatile | <0> | |
| [Transducer Serial Number] | Transducer Sr No | Unsigned int 32 bits | Non-Volatile | <123> | |

| Entity | SmartView Display | Data Type | Type | Default | Function |
|---|---|---|---|---|---|
| [PV Lower range value] | Lw Range Value | Float | Non-Volatile | <0> | Sensor (Analog Output) |
| [PV Upper range value] | Up Range Value | Float | Non-Volatile | <0> | |
| [Analog Output mode] | HART Mode | Enumeration <Fixed 4-20mA> <Standard 4-20mA> | Non-Volatile | <Standard 4-20mA> | |
| [Burnout Value] | Burnout Value | Float | Non-Volatile | <3.6> | |
| [Burnout Behavior] | Burnout Behavior | Enumeration <BAD> <UNCERTAIN> <BAD + UNCERTAIN> | Non-Volatile | <BAD> | |
| [Enter Calibration Mode] | Enter Cal Mode | Undefined | Command | | |
| [Cal Value at 4 mA] | Cal Value at 4 mA | Float | Non-Volatile | <0> | |
| [Cal Value at 18 mA] | Cal Value at 18 mA | Float | Non-Volatile | <0> | |
| [Calibrate at 4 mA] | Calibrate at 4 mA | Undefined | Command | | |
| [Calibrate at 18 mA] | Calibrate at 18 mA | Undefined | Command | | |
| [Exit Calibration Mode] | Exit Cal Mode | Undefined | Command | | |

### 7.10.5.2 Commissioning

*Engauge*
*SmartView*

☛The following entities ***must*** be set by *Engauge* or *SmartView* for a correct functioning of the HCI-HAO module in an instrument.

| Name | Explanation | Default Value | Function Part | Function |
|---|---|---|---|---|
| [PV Link board ID] | Board ID of Other FlexConn to be linked as PV to HCI-HAO | <0> | Board | Board Specific |
| [PV Link board instance] | Board Instance of the linked PV board | <0> | | |
| [PV Link function instance] | Function Instance of the linked PV board | <0> | | |
| [PV Link Sensor Value]* | Primary or secondary variable of linked card can be assigned to this | <PV_LINK> | | |

| Name | Explanation | Default Value | Function Part | Function |
|---|---|---|---|---|
| [HART PV unit code] | Unit code for linked PV | <UNIT_CODE_UNKNOWN> | Function 1 | Communication (HART communication) |
| [HART Upper Transducer Limit] | Upper transducer limit for connected sensor of linked PV board | <0> | | |
| [HART Lower Transducer Limit] | Lower transducer limit for connected sensor of linked PV board | <0> | | |
| [Polling Address] | Polling address of the device, which is used for poll-based addressing | <0> | | |
| [Transducer Serial Number] | Transducer serial number of connected sensor of linked PV board | <123> | | |
| [Upper Range Value] | Upper range value for PV. This value is used to calculate the analog output current. | <0> | Function 2 | Sensor (Analog Output) |
| [Analog Output at 4mA] | Calibration reading when [Calibrate at 4 mA] command is given | <0> | | |
| [Analog Output at 18 mA] | Calibration reading when [Calibrate at 18 mA] command is given | <0> | | |
| [Lower Range Value] | Lower range value for PV. This value is used to calculate the analog output current. | <0> | | |
| [Analog Burnout Value] | Analog burnout value in case of malfunctioning device | <3.6mA> | | |

*) Default values for entities marked in GREEN in the above table could be considered as proper values for making the health for respective Function or Board <GOOD>. However, the user is free to choose these values as per the requirement along with the rest of the entities.

All the entities in the above table would be initialized to their *default* values after [init novram] command is given. All the entities should have their proper values so as to make the respective Function and Board health to <GOOD> status.
The [Analog Output at 4 mA] and [Analog Output at 18 mA] fields should be entered after giving proper calibration commands (for more details, see 7.10.4).

☛The following entities ***can*** be set by *Engauge* or *SmartView* for a correct functioning of the HCI-HAO module in an instrument.

If one needs to assign SV, TV, QV to HCI-HAO then the corresponding unit codes also needs to be set properly so that the value read from other FlexConn board will be proper.

| Name | Explanation | Default Value | Function Part | Function |
|---|---|---|---|---|
| [SV Link board ID] | Board ID of Other FlexConn which is linked as SV to HCI-HAO | <0> | Board | Board Specific |
| [SV Link board instance] | Board Instance of the linked SV board | <0> | | |
| [SV Link function instance] | Function Instance of the linked SV board | <0> | | |
| [TV Link board ID] | Board ID of Other FlexConn which is linked as TV to HCI-HAO | <0> | | |
| [TV Link board instance] | Board Instance of the linked TV board | <0> | | |
| [TV Link function instance] | Function Instance of the linked TV board | <0> | | |
| [QV Link board ID] | Board ID of Other FlexConn which is linked as QV to HCI-HAO | <0> | | |
| [QV Link board instance] | Board Instance of the linked QV board | <0> | | |
| [QV Link function instance] | Function Instance of the linked QV board | <0> | | |
| [Linked Primary Value] | PV / SV value of linked PV board in the set unit code | <0> | | |
| [Linked Secondary Value] | PV value of linked SV board in the set unit code | <0> | | |
| [Linked Tertiary Value] | PV value of linked TV board in the set unit code | <0> | | |
| [Linked Quarternary Value] | PV value of linked QV board in the set unit code | <0> | | |

| Name | Explanation | Default Value | Function Part | Function |
|---|---|---|---|---|
| [HART SV unit code] | Unit code for linked SV | <UNIT_CODE_UNKNOWN> | Function 1 | Communication (HART communication) |
| [HART TV unit code] | Unit code for linked TV | <UNIT_CODE_UNKNOWN> | | |
| [HART QV unit code] | Unit code for linked QV | <UNIT_CODE_UNKNOWN> | | |
| [Configuration changed Counter] | Increments every time the configuration is changed | <0> | | |
| [Device ID] | Same as Enraf Serial number. This is a unique number to every board. | | | |
| [Device Type] | Device type registered with the HART Communication Foundation | <127> | | |
| [Manufacturer ID Number] | Manufacturer ID registered with the HART Communication Foundation | <148> | | |
| [Number of Preambles] | Number of preambles required for a request from the HART master | <7> | | |
| [Number of Response Preambles] | Number of preambles in the HCI-HAO response stream | <7> | | |
| [Fixed Current Value] | Fixed analog output current set by HART command 40 | <0> | Function 2 | Sensor (Analog Output) |
| [Loop Current Mode] | If HART mode selected is <Standard 4-20mA>, then it is enabled.<br>If HART mode selected is <Fixed 4-20mA>, then it is disabled. | <Enabled> | | |
| [Percentage of Range] | Percentage of current PV with respect to the limits set | <0> | | |

### 7.10.6 Hardware Configuration

#### 7.10.6.1 Jumper Allocation

The following are typical jumper settings done on the HCI-HAO board.

| Jumper Number | Position | Connection Details | Description | Default Position | Default Connections |
|---|---|---|---|---|---|
| JP1 | ON | Short 2 & 3 | W&M Entity Protection | OFF | Short 1 & 2 |
| JP2 | ON | Short 2 & 3 | Password Read Protection | OFF | Short 1 & 2 |
| JP3 | ON | Short 2 & 3 | Write Protection All Entities | OFF | Short 1 & 2 |
| JP4 | ON | Short 2 & 3 | Free | OFF | Short 1 & 2 |
| JP5 | ON | Short 2 & 3 | Free | OFF | Short 1 & 2 |
| JP6 | ON | Short 2 & 3 | CAN termination 120E resistor | OFF | Short 1 & 2 |
| JP7 & JP8 | A | Short 1 & 2 | Active mode for Analog Output | A | Short 1 & 2 |
| JP7 & JP8 | P | Short 2 & 3 | Passive mode for Analog Output | | |

#### 7.10.6.2 Terminal Allocation

t.b.d.

#### 7.10.6.3 LED Allocation

| LED Number | Function |
|---|---|
| LE2 | HART data Transmit |
| LE3 | HART data Receive |

## 7.11 Average Temperature & Water Level Measurement (FII-VT)

### 7.11.1 Introduction

The Field Interface Instrument - VITO[1] (FII-VT) board is a VITO-data processor module, which calculates average product- and Vapour temperatures, and optionally a water level.

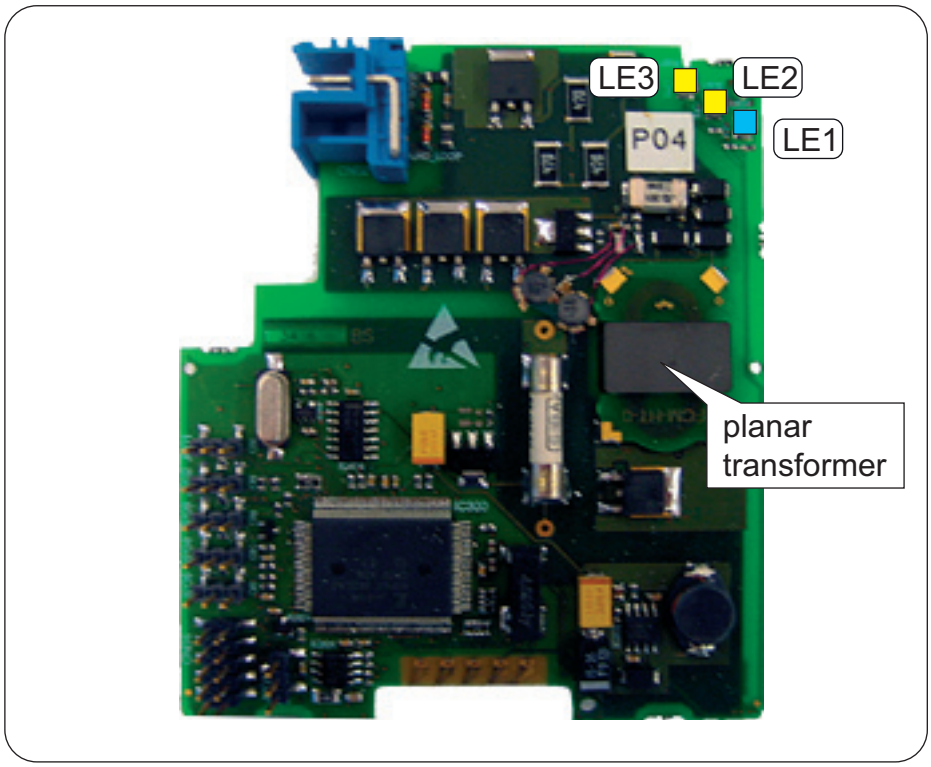



FIGURE 7-35 The FII-VT board with its planar transformer F4A07-0016

By using the HART® protocol (see also 7.9.1), the FII-VT module can be connected to one VITO-interface which in turn is connected to a probe for *product temperature*, *Vapour temperature*, *water level*, or a combination of these.

The FII-VT board has a planar transformer for galvanic isolation from the HART bus. See FIGURE 7-35.

LED LE1 is the board's [Health] LED. LEDs LE2 and LE3 will be flashing to indicate activity on the HART bus. LE2 indicates data is being transmitted (Tx), LE3 indicates data is being received (Rx).

1. Versatile In-Tank Observer

### 7.11.2 VITO Interface Types

For temperature and/or water level measurement, a proper VITO probe must be connected to the FII-VT module, using a VITO interface.

There are 3 VITO interface types:

- 762 VITO MTT interface for 16-spot temperature measurement (*thermocouple principle*) and optionally a water bottom measurement
- 762 VITO LT interface for 9-spot temperature measurement (*thermocouple principle*) and optionally a water bottom measurement
- 762 VITO MRT interface for Multiple Resistance Thermometer and multi-spot (*resistance variation principle*) measurement

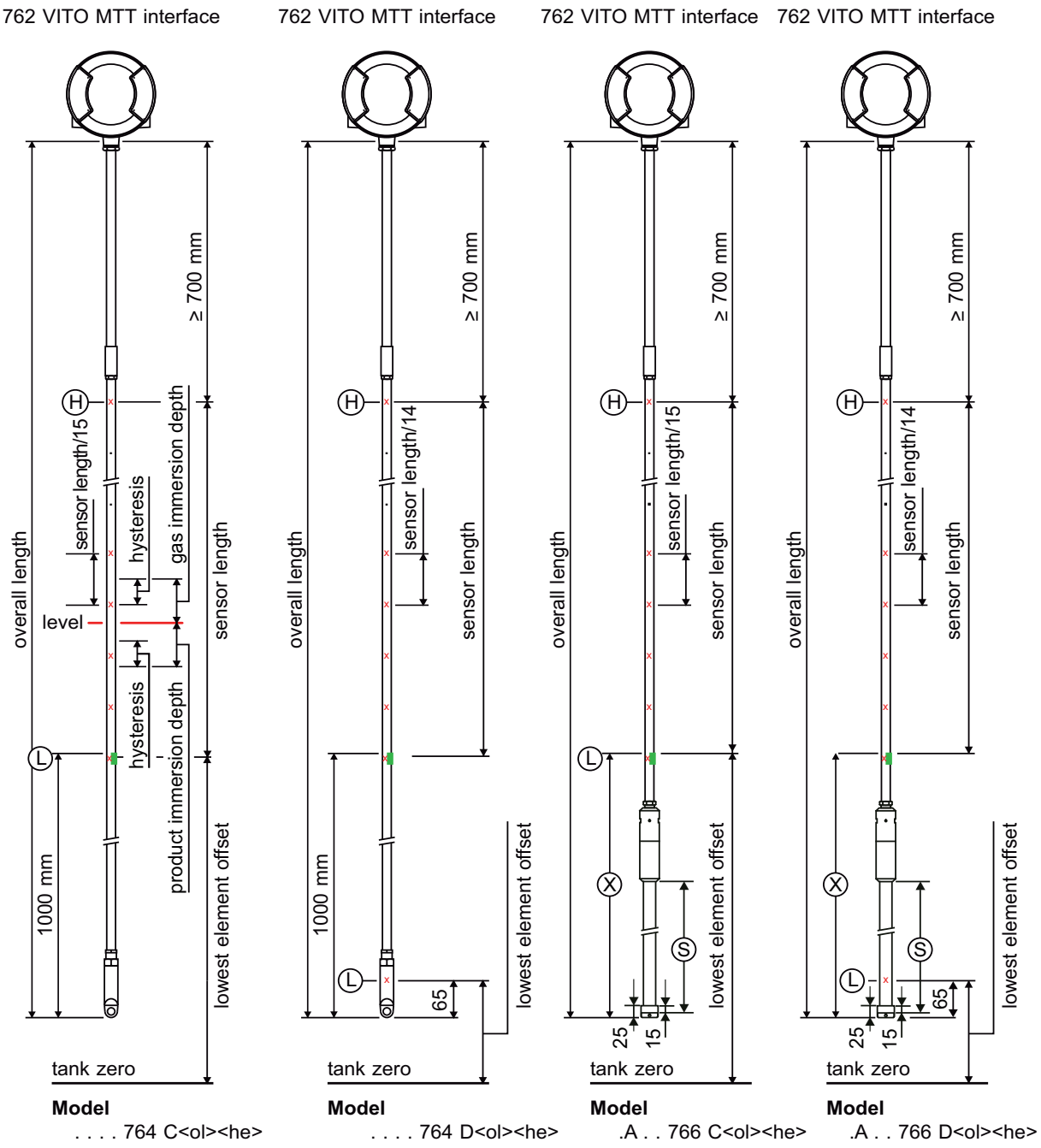
### 7.11.3 Commissioning

#### 7.11.3.1 Commissioning Parameters for MTT/LT Probes

The following 9 configurations are possible:

| Enraf Model | VITO Type | Description |
|---|---|---|
| 764C | MTT Temperature probe | lowest spot next to Pt100, no water probe |
| 764D | | lowest spot below Pt100, no water probe |
| 766C | MTT Combi probe | lowest spot next to Pt100, combined with water probe |
| 766D | | lowest spot below Pt100, combined with water probe |
| 767C | LT Temperature probe | lowest spot next to Pt100, no water probe |
| 767D | | lowest spot below Pt100, no water probe |
| 768C | LT Combi probe | lowest spot next to Pt100, combined with water probe |
| 768D | | lowest spot below Pt100, combined with water probe |
| 765 | Water probe | water probe only |

These models are depicted in FIGURE 7-36 and FIGURE 7-37.




Pt 100 reference resistor
X Thermocouple (spot)

(H) Highest spot
(L) Lowest spot

(S) Sensitive length = 0.5 / 1.0 / 1.5 / 2.0 m
(X) Depending on actual Sensitive length, this length = 1.0 / 1.5 / 2.0 / 2.5 m

F4A07-0017

FIGURE 7-36 Tank and temperature probe data (1)

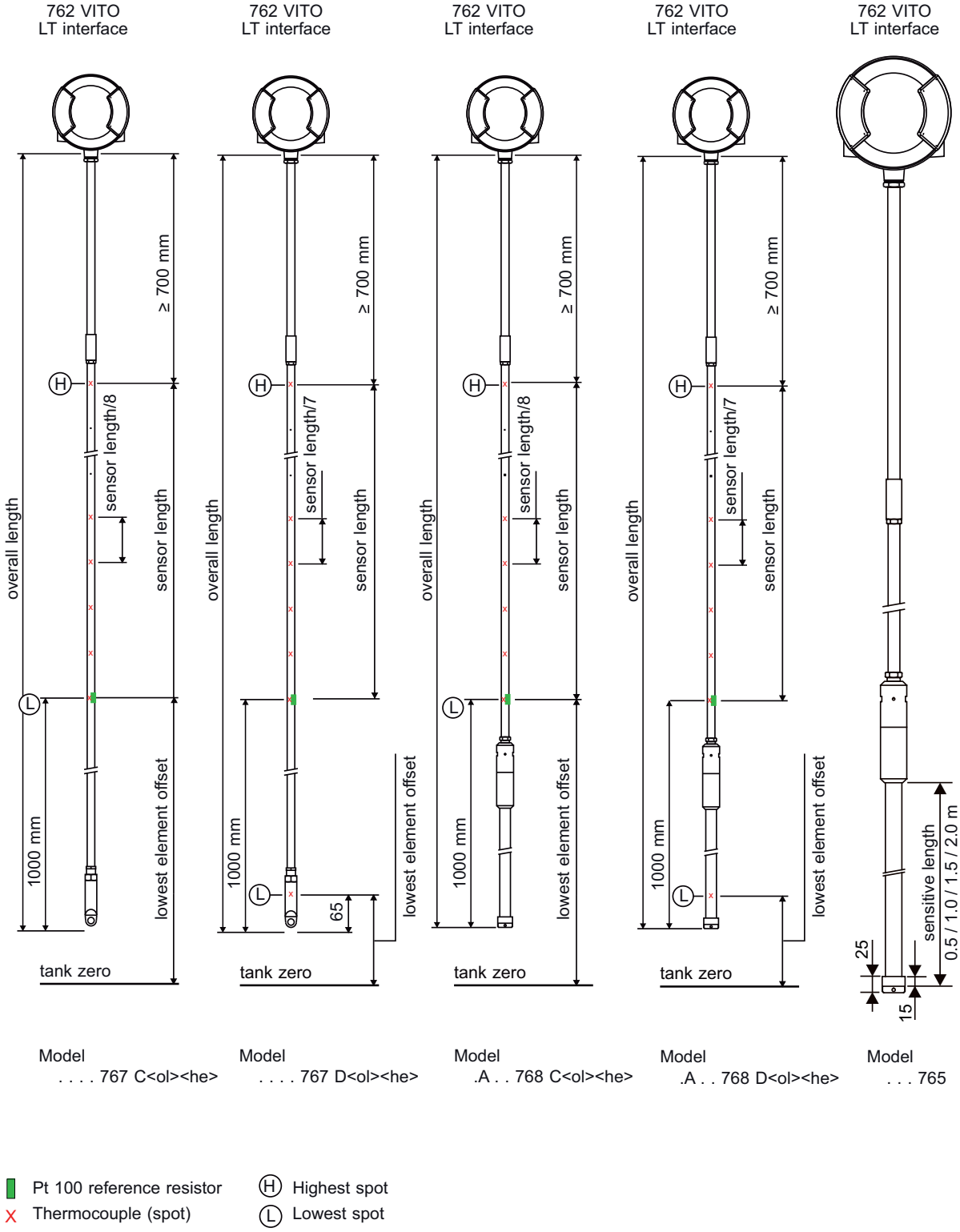



FIGURE 7-37 Tank and temperature probe data (2)

F4A07-0018

#### 7.11.3.1.1 Product Temperature

Engauge
SmartView

☛The following entities ***must*** be set by *Engauge* or *SmartView* for a correct functioning of the FII-VT module in an instrument.

*NOTE: Using Engauge, following entities are set within the Engauge **Product temperature** tab.*

| Name | Explanation | Value Range | Default |
|---|---|---|---|
| [Lowest element offset] | The distance from tank zero till the lowest element position in the temperature probe | floating point number: <-x.x .. +x.x> | <80.0> |
| [Sensor length] | The distance from the Pt100 position till the highest element position | floating point number: <-x.x .. +x.x> | <80.0> |

The following entities ***can*** be set by *Engauge* or *SmartView* for a correct functioning of the FII-VT module in an instrument.

Engauge
SmartView

☛Check each entity for its correctness.

| Name | Explanation | Value Range | Default |
|---|---|---|---|
| [Product immersion depth] | The minimum required distance of the product level above an element before it is taken into account in the average product temperature calculation | floating point number: <-x.x .. +x.x> | <0.5> |
| [Hysteresis] | The distance for a hysteresis mechanism around the switching point of the elements that are taken into account in the calculation | floating point number: <-x.x .. +x.x> | <0.1> |
| [High High alarm]<br>[High Alarm]<br>[Low Alarm]<br>[Low Low alarm]<br> | 4 thresholds for activating a related alarm status in the Primary Value | floating point number: <-x.x .. +x.x> | <+1.0E22> |

| Name | Explanation | Value Range | Default |
|---|---|---|---|
| [Alarm test enable] | Enables (*if* activated, see next listed entity) the simulation of one of the 4 alarms for a minute, by simulating the actual measured Primary Value is below or above the alarm threshold. | <enable><br><disable> | <disable> |
| [Alarm test] | Activates and selects at the same time the Alarm test (if enabled with the [Alarm test enable] listed before, and the 4 alarm thresholds are properly set). | [No Alarm]<br>[High High alarm]<br>[High Alarm]<br>[Low Alarm]<br>[Low Low alarm] | <No Alarm> |
| [Element wiring] | Used for excluding an element from the average product temperature calculation. | 16 characters<br>A non-zero (≠ 0) character at position **x** results in element **x** being excluded from calculation. | <0000000000000000> |
| [Function identification] | The current module's function name. This function is visible on the *SmartView* display. | 13 characters | <Product temp.> |

#### *7.11.3.1.2 Vapour Temperature*

*NOTE: Using Engauge, following entities are set within the Engauge **Vapour temperature** tab.*
*Some Vapour temperature settings are shared with Product temperature settings.*

The following entities ***can*** be set by *Engauge* or *SmartView* for a correct functioning of the FII-VT module in an instrument.

☛Check each entity for its correctness.

| Name | Explanation | Value Range | Default |
|---|---|---|---|
| [Gas immersion depth] | The minimum required distance below an element before it is taken into account in the average Vapour temperature calculation | floating point number:<br><-x.x .. +x.x> | <0.5> |
| [High High alarm]<br>[High Alarm]<br>[Low Alarm]<br>[Low Low alarm] | 4 thresholds for activating a related alarm status in the Primary Value | floating point number:<br><-x.x .. +x.x> | <+1.0E22> |

| Name | Explanation | Value Range | Default |
|---|---|---|---|
| [Alarm test enable] | Enables (*if* activated, see next listed entity) the simulation of one of the 4 alarms for a minute, by simulating the actual measured Primary Value is below or above the alarm threshold. | <enable><br><disable> | <disable> |
| [Alarm test] | Activates and selects at the same time the Alarm test (if enabled with the [Alarm test enable] listed before, and the 4 alarm thresholds are properly set). | [No Alarm]<br>[High High alarm]<br>[High Alarm]<br>[Low Alarm]<br>[Low Low alarm] | <No Alarm> |
| [Function identification] | The current module's function name. This function is visible on the *SmartView* display. | 13 characters | <Vapour temp.> |

#### *7.11.3.1.3 Water Level (for 766/768 Combi probes and 765 Water probe only)*

*Engauge*
*SmartView*

☛The following entities ***must*** be set by *Engauge* or *SmartView* for a correct functioning of the FII-VT module in an instrument.

| Name | Explanation | Value Range | Default |
|---|---|---|---|
| [Maximum water capacity] | The maximum capacity when the probe is fully submerged in water (in pF) | floating point number:<br><-x.x .. +x.x> | <20000> |
| [Minimum water capacity] | The minimum capacity when the probe is not submerged in water (in pF) | floating point number:<br><-x.x .. +x.x> | <20000> |
| [Water probe bottom position] | The offset to the water probe zero point in relation with the tank zero point | floating point number:<br><-x.x .. +x.x> | <80> |
| [Upper reference level] | The distance from tank zero point to upper reference point; is used for water ullage calculation | floating point number:<br><-x.x .. +x.x> | <80> |

*Engauge*
*SmartView*

☛The following entities ***can*** be set by *Engauge* or *SmartView* for a correct functioning of the FII-VT module in an instrument.

| Name | Explanation | Value Range | Default |
|---|---|---|---|
| [Water probe length] | The length of a water probe | floating point number:<br><-x.x .. +x.x> | <0.5> |

| Name | Explanation | Value Range | Default |
|---|---|---|---|
| [High High alarm]<br>[High Alarm]<br>[Low Alarm]<br>[Low Low alarm]<br> | 4 thresholds for activating a related alarm status in the Primary Value | floating point numbers:<br><-x.x .. +x.x> | <+1.0E22> |
| [Alarm test enable]<br> | Enables (*if* activated, see next listed entity) the simulation of one of the 4 alarms for a minute, by simulating the actual measured Primary Value is below or above the alarm threshold. | <enable><br><disable> | <disable> |
| [Alarm test]<br> | Activates and selects at the same time the Alarm test (if enabled with the [Alarm test enable] listed before, and the 4 alarm thresholds are properly set). | [No Alarm]<br>[High High alarm]<br>[High Alarm]<br>[Low Alarm]<br>[Low Low alarm] | <No Alarm> |
| [Function identification]<br> | The current module's function name. This function is visible on the *SmartView* display. | 13 characters | <Water level> |

### 7.11.3.2 Commissioning Parameters for MRT or RTD

| Enraf Model | VITO Type | Description |
|---|---|---|
| MRT | Multiple Resistance Thermometer | MRT with up to 13 temperature elements with one spot element |
| RTD | 3-spot<br>Resistance Temperature Detector | 1..3 RTD spots in a 3-wire connection |
| | multi-spot<br>Resistance Temperature Detector | 1..14 RTD spots in a 2-wire connection |

See FIGURE 7-38 and FIGURE 7-39.

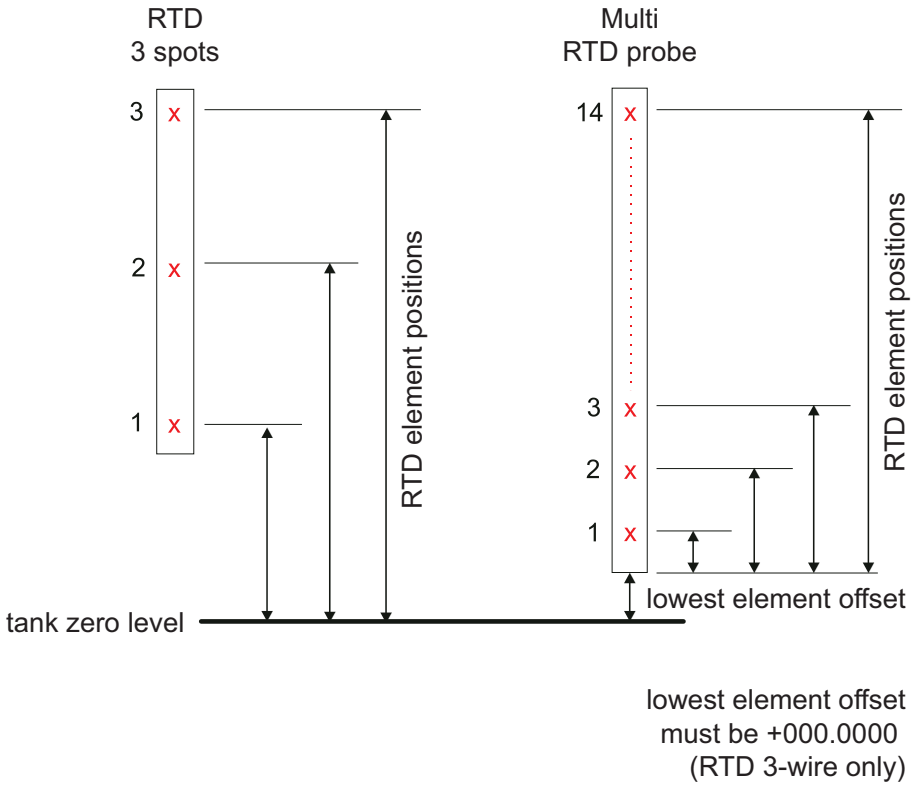



FIGURE 7-38 Resistance Temperature Detector (RTD) elements positions F4A07-0020

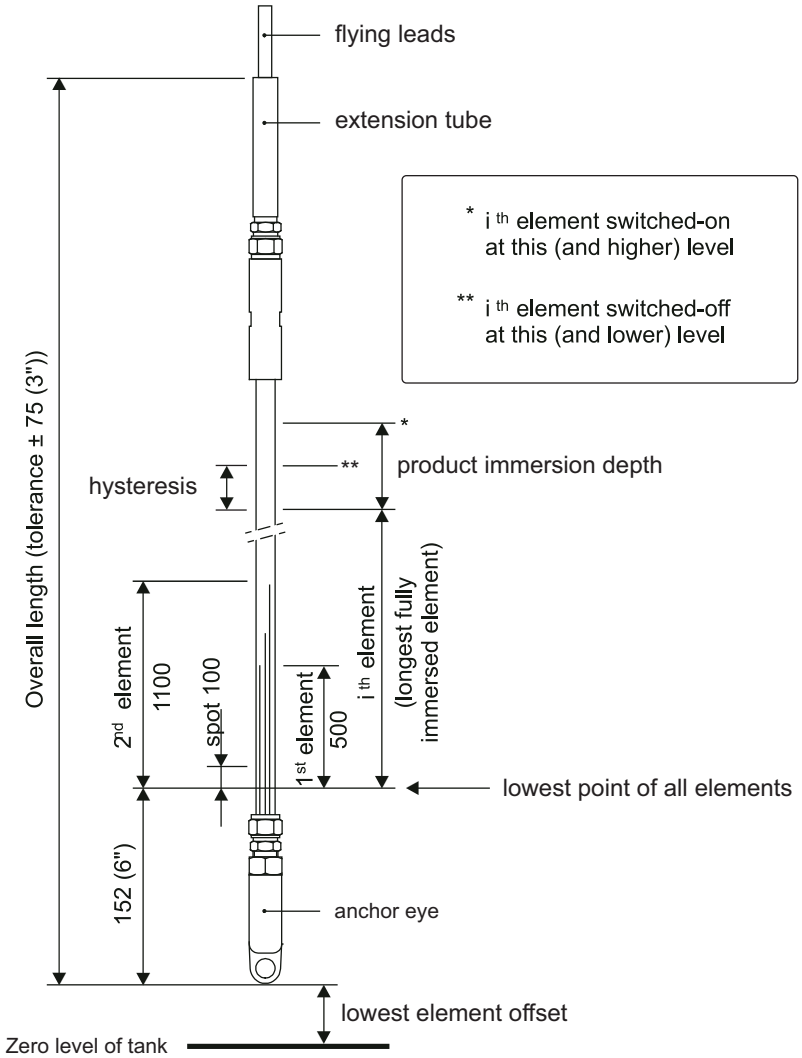



FIGURE 7-39 Multiple Resistance Thermometer (MRT) parameters F4A07-0019

### 7.11.3.2.1 *Product Temperature*

*Engauge*
*SmartView*

☛ The following entities ***must*** be set by *Engauge* or *SmartView* for a correct functioning of the FII-VT module in an instrument.

*NOTE: Using Engauge, following entities are set within the Engauge* ***Product temperature*** *tab.*

- RTD 3 spots (see FIGURE 7-38 *left* side)

| Name | Explanation | Value Range | Default |
|---|---|---|---|
| [Element type] | The supported element type is: SPL | 3 characters<br><SPL> | <---> |
| [Number of elements] | The number of elements a RTD probe has | <1 .. 3> | <0> |
| [Lowest element offset] | The distance from tank zero till the lowest position of the multi-RTD probe.<br>So **not** used for the 3-wire version and it must be 0. | floating point number:<br><-x.x .. +x.x><br><br>MUST BE <0.0> | <80.0> |
| [RTD element positions] | The positions of the RTDs from tank zero level | 3 floating point numbers:<br><-x.x .. +x.x><br>Note: Only *actually used* elements to be entered. | <0,0,0> |

- Multi RTD probe (see FIGURE 7-38 *right* side)

| Name | Explanation | Value Range | Default |
|---|---|---|---|
| [Element type] | The supported element type is : SPL | 3 characters<br><SPL> | <---> |
| [Number of elements] | The number of elements a RTD probe has | <1 .. 14> | <0> |
| [Lowest element offset] | The distance from tank zero till the lowest position of the multi-RTD probe | floating point number:<br><-x.x .. +x.x> | <80.0> |
| [RTD element positions] | The positions of the RTDs from the lowest position of the probe.<br>So **not** tank zero level! | 14 floating point numbers:<br><-x.x .. +x.x><br>Note: Only *actually used* elements to be entered. | <0,0,0,0,0,0,0,0,0,0,0,0,0,0> |

- MRT (see FIGURE 7-39)

| Name | Explanation | Value Range | Default |
|---|---|---|---|
| [Element type] | See Table TABLE 6-19 below. | 3 characters<br><RCB><br><RCN><br><RCS><br><QCB><br><QCN><br><QCS> | <---> |
| [Number of elements] | The number of elements (resistors) an MRT probe has | <1 .. 14> | <0> |
| [Lowest element offset] | The distance from tank zero till the lowest position of the MRT probe | floating point number:<br><-x.x .. +x.x> | <80.0> |
| [MRT element length] if MRT length table = <T> | The lengths of the MRTs including anchor eye | 14 floating point numbers:<br><-x.x .. +x.x> | <0,0,0,0,0,0,0,0,0,0,0,0,0,0> |
| [MRT length table] | Specifies whether a fixed range of MRT resistors is used (= <F>) or user-configured lengths (= <T>).<br><br>Fixed lengths are:<br>0.25 / 0.65 / 1.25 / 1.95 / 2.85 / 4.15 / 5.65 / 7.35 / 9.25 / 11.65 / 14.65 / 18.45 / 22.95 / 29.65 | 1 character<br><F><br><T> | <F> |

| | |
|---|---|
| **R..** | = an MRT *without* spot element |
| **Q..** | = an MRT *with* spot element |
| **.CB** | Rth = 90.2935 + T x 0.38826 (- 100 through + 280 °C) |
| **.CN** | Rth = 90.4778 + T x 0.38090 (- 100 through + 280 °C) |
| **.CS** | Rth = 90.5000 + T x 0.38730 (- 100 through + 280 °C) |

TABLE 6-19 Element type definitions

The following entities ***can*** be set by *Engauge* or *SmartView* for a correct functioning of the FII-VT module in an instrument.

☛Check each entity for its correctness.

| Name | Explanation | Value Range | Default |
|---|---|---|---|
| [Product immersion depth] | The minimum required product level distance above an element before this element is taken into account in the average product temperature calculation | floating point number:<br><-x.x .. +x.x> | <0.5> |
| [Hysteresis] | This is a hysteresis mechanism distance around the switching points of the elements that are taken into account in the calculation. | floating point number:<br><-x.x .. +x.x> | <0.1> |
| [High High alarm]<br>[High Alarm]<br>[Low Alarm]<br>[Low Low alarm]<br> | 4 thresholds for activating a related alarm status in the Primary Value | floating point numbers:<br><-x.x .. +x.x> | <1.0E22> |
| [Alarm test enable]<br> | Enables (*if* activated, see next listed entity) the simulation of one of the 4 alarms for a minute, by simulating the actual measured Primary Value is below or above the alarm threshold. | <enable><br><disable> | <disable> |
| [Alarm test]<br> | Activates and selects at the same time the Alarm test (if enabled with the [Alarm test enable] listed before, and the 4 alarm thresholds are properly set). | [No Alarm]<br>[High High alarm]<br>[High Alarm]<br>[Low Alarm]<br>[Low Low alarm] | <No Alarm> |
| [Function identification]<br> | The current module's function name. This function is visible on the *SmartView* display. | 13 characters | <Product temp.> |

#### 7.11.3.2.2 *Vapour Temperature*

*NOTE: Using Engauge, following entities are set within the Engauge **Vapour temperature** tab.*
*Some Vapour temperature settings are shared with Product temperature settings.*

The following entities ***can*** be set by *Engauge* or *SmartView* for a correct functioning of the FII-VT module in an instrument.

☛Check each entity for its correctness.

| Name | Explanation | Value Range | Default |
|---|---|---|---|
| [Gas immersion depth] | The minimum required distance below an element before it is taken into account in the average Vapour temperature calculation | floating point number:<br><-x.x .. +x.x> | <0.5> |
| [High High alarm]<br>[High Alarm]<br>[Low Alarm]<br>[Low Low alarm]<br> | 4 thresholds for activating a related alarm status in the Primary Value | floating point numbers:<br><-x.x .. +x.x> | <+1.0E22> |
| [Alarm test enable]<br> | Enables (*if* activated, see next listed entity) the simulation of one of the 4 alarms for a minute, by simulating the actual measured Primary Value is below or above the alarm threshold. | <enable><br><disable> | <disable> |
| [Alarm test]<br> | Activates and selects at the same time the Alarm test (if enabled with the [Alarm test enable] listed before, and the 4 alarm thresholds are properly set). | [No Alarm]<br>[High High alarm]<br>[High Alarm]<br>[Low Alarm]<br>[Low Low alarm] | <No Alarm> |
| [Function identification]<br> | The current module's function name. This function is visible on the *SmartView* display. | 13 characters | <Vapour temp.> |

### 7.11.3.3 Commissioning Parameters for the 765 VITO Water Probe

For the entities to be set for the stand-alone 765 VITO water probe (see FIGURE 7-40), see 7.11.3.3.1.

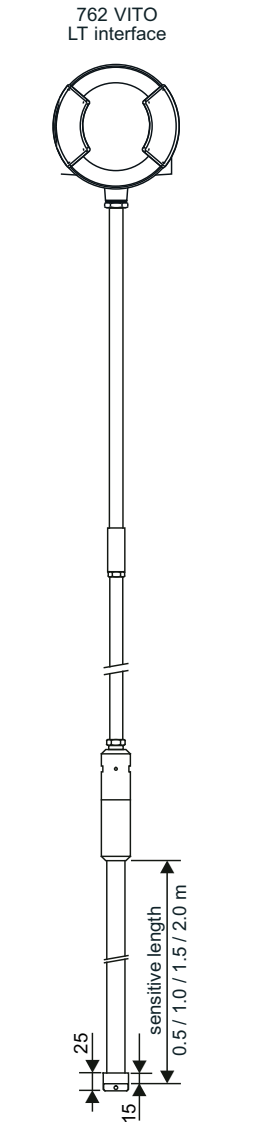



FIGURE 7-40 The model 765 VITO water probe

F4A07-0042

#### 7.11.3.3.1 Water Level

Engauge
SmartView

☛ The following entities ***must*** be set by *Engauge* or *SmartView* for a correct functioning of the FII-VT module in an instrument.

| Name | Explanation | Value Range | Default |
|---|---|---|---|
| [Maximum water capacity] | The maximum capacity when the probe is fully submerged in water (in pF) | floating point number: <-x.x .. +x.x> | <20000> |
| [Minimum water capacity] | The minimum capacity when the probe is not submerged in water (in pF) | floating point number: <-x.x .. +x.x> | <20000> |
| [Water probe bottom position] | The offset to the water probe zero point in relation with the tank zero point | floating point number: <-x.x .. +x.x> | <80> |
| [Upper reference level] | The distance from tank zero point to upper reference point; is used for water ullage calculation | floating point number: <-x.x .. +x.x> | <80> |

Engauge
SmartView

☛ The following entities ***can*** be set by *Engauge* or *SmartView* for a correct functioning of the FII-VT module in an instrument.

| Name | Explanation | Value Range | Default |
|---|---|---|---|
| [Water probe length] | The length of the 765 VITO water probe | floating point number: <-x.x .. +x.x> | <0.5> |
| [High High alarm]<br>[High Alarm]<br>[Low Alarm]<br>[Low Low alarm]<br> | 4 thresholds for activating a related alarm status in the Primary Value | floating point numbers: <-x.x .. +x.x> | <+1.0E22> |
| [Alarm test enable]<br> | Enables (*if* activated, see next listed entity) the simulation of one of the 4 alarms for a minute, by simulating the actual measured Primary Value is below or above the alarm threshold. | <enable><br><disable> | <disable> |

| Name | Explanation | Value Range | Default |
|---|---|---|---|
| [Alarm test] | Activates and selects at the same time the Alarm test (if enabled with the [Alarm test enable] listed before, and the 4 alarm thresholds are properly set). | [No Alarm]<br>[High High alarm]<br>[High Alarm]<br>[Low Alarm]<br>[Low Low alarm] | <No Alarm> |
| [Function identification] | The current module's function name. This function is visible on the *SmartView* display. | 13 characters | <Water level> |

### 7.11.4 Commissioning Check

*Engauge*
*SmartView*

☛After having checked/set all before listed entities, make sure

- the [Board Commissioned], the [Product temperature Commissioned], the [Vapour temperature Commissioned], and - if applicable - the [Water level Commissioned] entities are <True>;
- the [Board Health], the [Product temperature Health], the [Vapour temperature Health], and - if applicable - the [Water level Health] entities are <GOOD>.

## 7.12 Average Temperature Measurement (FII-RTD)

### 7.12.1 Introduction

The Field Interface Instrument - Resistance Temperature Detector (FII-RTD) board is a sensor module for the instrument (gauge) and calculates average product- , Vapour- and ambient temperatures.

For accomplishing this, RTDs or MRTs must be directly connected to the FII-RTD module.

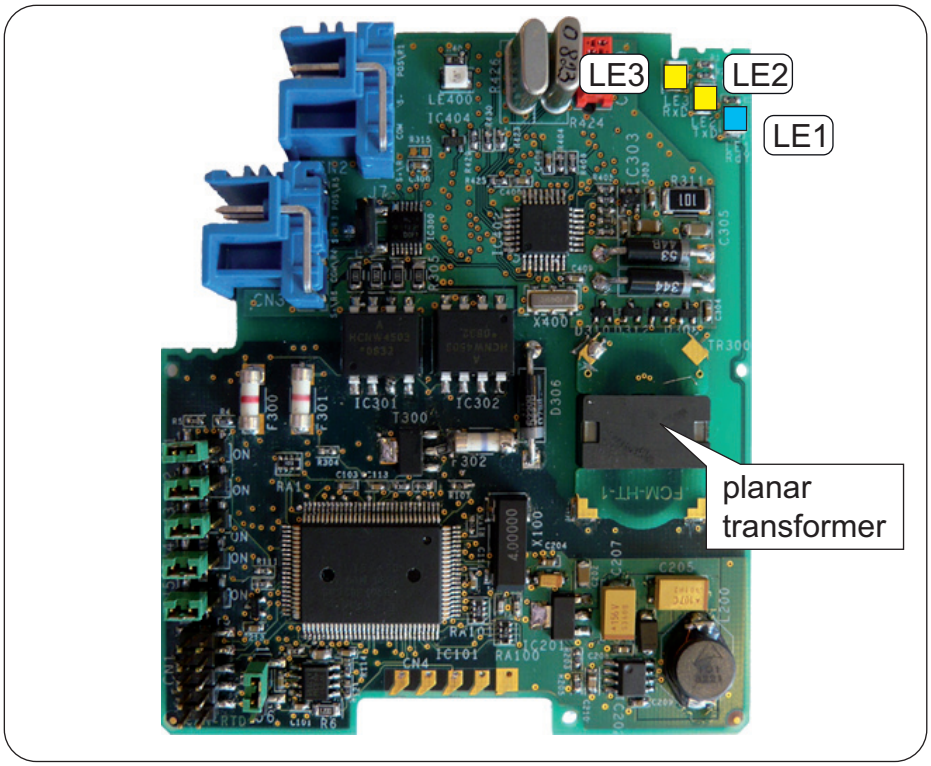



FIGURE 7-41 The FII-RTD board F4A09-0008

There are four possible configurations to calculate the average product, Vapour, and ambient temperatures using the FII-RTD board.

- 1 or 2 RTDs in a 3-wire configuration.
- 1 or 2 RTDs in a 4-wire configuration.
- 2 through 6 RTDs as a probe called MPT. It should contain 1 wire per RTD + 2 common wires for all RTDs.
- 2 through 6 MRTs as a probe. It should contain 1 wire per MRT + 2 common wires for all MRTs.

*NOTE: Only in RTD 3-wire or 4-wire configurations ambient temperature calculation is possible.*

### 7.12.2 Some Important Settings

The FII-RTD can be tailored to the need of the customer by a lot of settings. See 7.12.4 - Commissioning.

Some important settings of the FII-RTD in Board Specific tab are listed below.

| Setting | Remarks |
|---|---|
| [Measurement type] | ″ MPT<br>″ MRT<br>″ Mtt<br>″ No measurement type<br>″ RTD 3-wire<br>″ RTD 4-wire |
| [Element type] | ″ Cu100<br>″ Cu90 Beacon<br>″ Cu90 Enraf<br>″ Cu90 Nulectrohms<br>″ Ni191<br>″ No element type<br>″ Pt100 large<br>″ Pt100 small<br>″ PtCu100<br>″ Sangamo MRT<br>″ Sangamo spot<br>″ Thermocouple |
| [RTD configuration] | • RTD1 in tank<br>• RTD1 + RTD2 in tank<br>• RTD1 in tank + RTD2 ambient<br>• RTD1 ambient<br>″ No RTD configuration<br>″ RTD1 in tank<br>″ RTD1 in tank + RTD2 ambient |
| [Gauge temperature scale] | Can be:<br>• IPTS-68<br>• ITS-90 |
| [Lowest element offset] | This is the distance from tank bottom till lowest element position |
| [Number of elements] | Can be 1..6 |
| [MPT sensor length] | - |

### 7.12.3 Some Important Features

- Temperature calculations can be:
  - ″ *Standard* (just simple averaging the spot temperatures).
  - ″ *Enhanced* (averaging the spot temperatures and taking into account the contribution of each spot in respect to its immersion).
  - ″ *Custom* (as *standard* but then giving it a weighing factor).

- A *temperature-range check* can be turned on. In this case, if spot elements are out of range, a fail state results (if not skipped), see FIGURE 7-42.

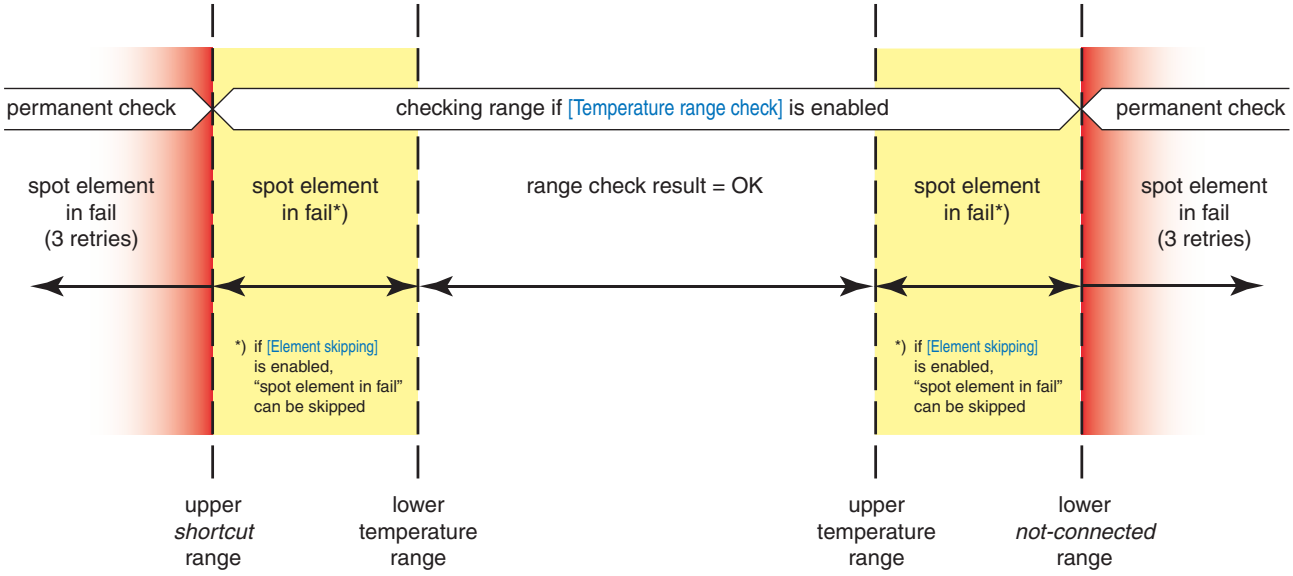
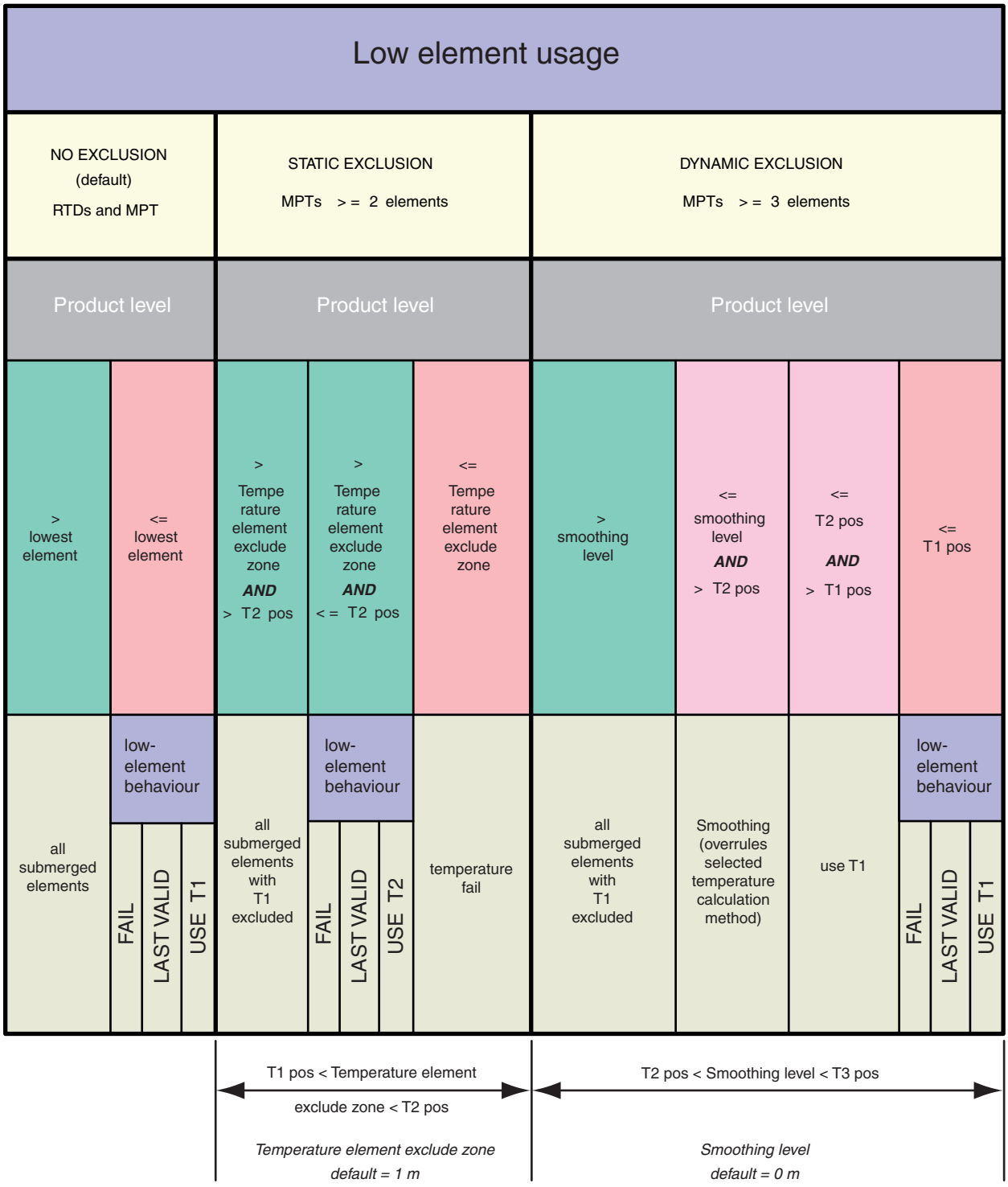

permanent check
checking range if [Temperature range check] is enabled
permanent check
spot element in fail (3 retries)
spot element in fail*)
range check result = OK
spot element in fail*)
spot element in fail (3 retries)
*) if [Element skipping] is enabled, "spot element in fail" can be skipped
*) if [Element skipping] is enabled, "spot element in fail" can be skipped
upper shortcut range
lower temperature range
upper temperature range
lower not-connected range

FIGURE 7-42 Temperature range check feature

F4A09-0006

- A *median filter* can be turn on or off, which eliminates spikes of each individual calculated spot tempearture.
- An *averaging constant filter* can be turned on or off, which takes a certain part of the previous calculated average temperature and a certain part of the new calculated temperature into account.
- *Low element usage* with following possible sub-settings can be applied:
  - ″ No exclusion
  - ″ Static exclusion
  - ″ Dynamic exclusion
    These settings are then to be refined further with:
  - ″ Exclude zone
  - ″ Smoothing level
  - ″ Low element behaviour

See FIGURE 7-43 on next page.




F4A09-0007

FIGURE 7-43 Low element usage settings overview

- *W&M Sealing*[1]: This board can be electronically sealed via the software. A Notified Body can set his password via [W&M notified body seal password]. He can apply the seal by setting [W&M seal]. Here some data logging is filled in and the related password. This requires a W&M module for Engauge.
  If the primary value of the product temperature is completely valid, then a W&M indication will be set (e.g. visible in SmartView).

  Unsealing: give the [W&M unseal level 1] and [W&M unseal the level 2] commands successively.

  History can be made visible via [W&M seal history].

### 7.12.4 Commissioning

#### 7.12.4.1 Commissioning Parameters for 1 or 2 RTDs (3- and 4-wire) Temperature Calculations

*NOTE: Make sure the RTD/MPT jumper is set to RTD.*

☛The following entities ***must*** be set by *Engauge* or *SmartView* for a correct functioning of the FII-RTD module in an instrument. The default values are available after initialization of the non-volatile memory.

| Name | Explanation | Value Range | Default |
|---|---|---|---|
| [Lowest element offset] | The distance from tank zero till the first RTD | floating point number: <-x.x .. +x.x> | <80.0> |
| [Second element offset] if applicable | The distance from tank zero till the second RTD | floating point number: <-x.x .. +x.x> | <0.0> |
| [Number of elements] | The number of RTDs used | <1..2> | <0> |
| [Element type] | The type (material) of the used RTDs | <Pt100 large + small><br><Ni191><br><PtCu100><br><Cu100><br><Cu90 enraf + beacon + weston/ solartron/nulectrohms><br><Sangamo MRT><br><Sangamo spot> | <No type> |
| [Measurement type] | Selects **RTD**s, MPT, or MRT. | <RTD 3wire><br><RTD 4wire><br><MPT><br><MRT> | <No type> |
| [RTD configuration] | Selects how the RTDs are positioned. | <RTD1 in tank><br><RTD1 and RTD2 in tank><br><RTD1 in tank and RTD2 ambient> <RTD1 ambient> | <No configuration> |

1. Weights & Measures Sealing.

### 7.12.4.2 Commissioning Parameters for MPT Temperature Calculations

*NOTE: Make sure the RTD/MPT jumper is set to MPT.*

☛ The following entities ***must*** be set set by *Engauge* or *SmartView* for a correct functioning of the FII-RTD module in an instrument. The default values are available after initialization of the non-volatile memory.

| Name | Explanation | Value Range | Default |
|---|---|---|---|
| [Lowest element offset] | The distance from tank zero till the bottom of the probe | floating point number:<br><-x.x .. +x.x> | <80.0> |
| [Number of elements] | The number of elements used | <1..6> | <0> |
| [Element type] | The type (material) of the used RTDs | <Pt100 large + small><br><Ni191><br><PtCu100><br><Cu100><br><Cu90 enraf + beacon + weston/ solartron/nulectrohms><br><Sangamo MRT><br><Sangamo spot> | <No type> |
| [Measurement type] | Selects RTDs, **MPT**, or MRT. | <RTD 3wire><br><RTD 4wire><br><MPT><br><MRT> | <No type> |
| [MPT sensor length] | The length of the MPT probe | floating point number:<br><-x.x .. +x.x> | <80.0> |

### 7.12.4.3 Commissioning Parameters for MRT Temperature Calculations

*NOTE: Make sure the RTD/MPT jumper is set to MRT (= MPT position).*

☛ The following entities ***must*** be set set by *Engauge* or *SmartView* for a correct functioning of the FII-RTD module in an instrument. The default values are available after initialization of the non-volatile memory.

| Name | Explanation | Value Range | Default |
|---|---|---|---|
| [Lowest element offset] | The distance from tank zero till the bottom of the probe | floating point number:<br><-x.x .. +x.x> | <80.0> |
| [Number of elements] | The number of elements used | <1..6> | <0> |

| Name | Explanation | Value Range | Default |
|---|---|---|---|
| [Element type] | The type (material) of the used RTDs | <Pt100 large + small><br><Ni191><br><PtCu100><br><Cu100><br><Cu90 enraf + beacon + weston/ solartron/nulectrohms><br><Sangamo MRT><br><Sangamo spot> | <No type> |
| [Measurement type] | Selects RTDs, MPT, or **MRT**. | <RTD 3wire><br><RTD 4wire><br><MPT><br><MRT> | <No type> |

#### 7.12.4.4 Commissioning Parameters for All Types of Probes

##### *7.12.4.4.1 Engauge *Product temperature* Tab*

*Engauge*
*SmartView*

☛ The following entities ***can*** be set set by *Engauge* or *SmartView* for a specific functioning of the FII-RTD module in an instrument. The default values are available after initialization of the non-volatile memory; so check each entity for its correctness.

| Name | Explanation | Value Range | Default |
|---|---|---|---|
| [Product immersion depth] | The minimum required product level distance above an element before this element is taken into account in the average product temperature calculation | floating point number:<br><-x.x .. +x.x> | <0.5> |
| [Hysteresis] | This is a hysteresis mechanism distance around the switching points of the elements that are taken into account in the calculation. | floating point number:<br><-x.x .. +x.x> | <0.1> |
| [High high alarm]<br>[High alarm]<br>[Low alarm]<br>[Low low alarm]<br> | 4 thresholds for activating a related alarm status in the Primary Value | floating point numbers:<br><-x.x .. +x.x> | <1.0E22> |

| Name | Explanation | Value Range | Default |
|---|---|---|---|
| [Alarm test enable] | Enables (*if* activated, see next listed entity) the simulation of one of the 4 alarms for a minute, by simulating the actual measured Primary Value is slightly below or above the alarm threshold. | <Enable><br><Disable> | <disable> |
| [Alarm test] | Activates and selects at the same time the Alarm test (if enabled with the [Alarm test enable] listed before, and the 4 alarm thresholds are properly set). | <No Alarm><br><High-high alarm><br><High alarm><br><Low alarm><br><Low-low alarm> | <No Alarm> |
| [Function identification] | The current module's function name. This function is visible on the *SmartView* display. | 13 characters | <Product temp.> |
| [Element offset] | Each element can individually be given an offset. | floating point numbers:<br><-x.x .. +x.x> | <0.0> |
| [Element weighing factor] | Each element can individually be given a weighing factor, which is applicable if the calculation method is CUSTOM. | floating point numbers:<br><-x.x .. +x.x> | <1.0> |
| [Gauge temperature scale] | Determines whether the IPTS-68 or ITS-90 scale is used. | <IPTS-68><br><ITS-90> | <ITS-90> |
| [Low element usage] | See FIGURE 7-43 | <No Exclusion><br><Static Exclusion><br><Dynamic Exclusion> | <No Exclusion> |
| [Low element behaviour] | See FIGURE 7-43 | <Temp To Fail><br><Temp To Last Valid><br><Temp Use First Element><br><Temp Use Second Element> | <Temp To Fail> |
| [Temperature element exclude zone] | See FIGURE 7-43 | floating point number:<br><-x.x .. +x.x> | <1.0> |
| [Smoothing level] | See FIGURE 7-43 | floating point numbers:<br><-x.x .. +x.x> | <0.0> |

| Name | Explanation | Value Range | Default |
|---|---|---|---|
| [MPT element position mode]<br>*[Only for MPT]*<br> | Determines whether the element positions are automatically calculated (based on sensor length) or manually entered. | <Automatically><br><Manually> | <Automatically> |
| [RTD element positions]<br>*[Only for MPT]*<br> | If MPT element position mode is MANUALLY then here the positions can be filled in. | floating point numbers:<br><-x.x .. +x.x> | <0.0> |
| [Averaging constant filter]<br> | Enables or disables a averaging constant filter. | <enable><br><disable> | <enable> |
| [Averaging constant]<br> | Value of how much of the old calculated value is used with respect to the new calculated value | <0.0 .. 1.0> | <0.9> |
| [Temperature range check]<br> | Enables or disables the fact that an element which is outside a temperature range will lead to temperature fail.<br>(See also FIGURE 7-42.) | <enable><br><disable> | <disable> |
| [Element skipping]<br> | Enables or disables the fact that elements can be skipped if an element is outside a temperature range. | <enable><br><disable> | <disable> |
| [Maximum skipped elements]<br> | The number of elements that can be skipped | <1,2> | <1> |
| [Median filter]<br> | Enables or disables a median filter of 5 levels deep (spike filtering). | <enable><br><disable> | <enable> |
| [Temperature calculation method]<br> | The way the average temperature is calculated (see also features above) | <Standard><br><Custom><br><Enhanced> | <Enhanced> |
| [MRT length table]<br>*[Only for MRT]*<br> | Specifies whether a fixed range of MRT resistors is used (= <F> ) or user configured lenghts (= <T>). Fixed lengths are:<br>0.65, 1.25, 1.95, 2.85, 4.15, 5.65 | 1 character<br><br><F><br><T> | <F> |

| Name | Explanation | Value Range | Default |
|---|---|---|---|
| [MRT element length<br>used if MRT length table is 'T']<br>*[Only for MRT]*<br> | The lengths of the MRTs including anchor eye | floating point numbers:<br><-x.x .. +x.x> | <0.0> |

#### *7.12.4.4.2 Engauge * Vapour temperature * Tab*

*NOTE: Some settings for Vapour temperature calculations are shared via the product temperature settings.*

☛The following entities ***can*** be set by *Engauge* or *SmartView* for a specific functioning of the FII-RTD module in an instrument. The default values are available after initialization of the non volatile memory; so check each entity for its correctness.

| Name | Explanation | Value Range | Default |
|---|---|---|---|
| [Gas immersion depth] | The minimum required distance below an element before it is taken into account in the average Vapour temperature calculation | floating point number:<br><-x.x .. +x.x> | <0.5> |
| [High High alarm]<br>[High Alarm]<br>[Low Alarm]<br>[Low Low alarm]<br> | 4 Thresholds for activating a related alarm status in the Primary Value | floating point numbers:<br><-x.x .. +x.x> | <+1.0E22> |
| [Alarm test enable]<br> | Enables (*if* activated, see next listed entity) the simulation of one of the 4 alarms for a minute, by simulating the actual measured Primary Value is below or above the alarm threshold. | <enable><br><disable> | <disable> |
| [Alarm test]<br> | Activates and selects at the same time the Alarm test (if enabled with the [Alarm test enable] listed before, and the 4 alarm thresholds are properly set). | [No Alarm]<br>[High High alarm]<br>[High Alarm]<br>[Low Alarm]<br>[Low Low alarm] | <No Alarm> |
| [Function identification]<br> | The name of the current function of this module. This name is visible on the SmartView. | 13 characters | <Vapour temp.> |

#### 7.12.4.4.3 *Engauge * Ambient temperature * Tab*

*NOTE: Some settings for ambient temperature calculations are shared via the product temperature settings.*

☛The following entities ***can*** be set by *Engauge* or *SmartView* for a specific functioning of the FII-RTD module in an instrument. The default values are available after initialization of the non volatile memory; so check each entity for its correctness.

| Name | Explanation | Value Range | Default |
|---|---|---|---|
| [High High alarm]<br>[High Alarm]<br>[Low Alarm]<br>[Low Low alarm]<br> | 4 Thresholds for activating a related alarm status in the Primary Value | floating point numbers:<br><-x.x .. +x.x> | <+1.0E22> |
| [Alarm test enable]<br> | Enables (*if* activated, see next listed entity) the simulation of one of the 4 alarms for a minute, by simulating the actual measured Primary Value is below or above the alarm threshold. | <enable><br><disable> | <disable> |
| [Alarm test]<br> | Activates and selects at the same time the Alarm test (if enabled with the [Alarm test enable] listed before, and the 4 alarm thresholds are properly set). | [No Alarm]<br>[High High alarm]<br>[High Alarm]<br>[Low Alarm]<br>[Low Low alarm] | <No Alarm> |
| [Function identification]<br> | The name of the current function of this module. This name is visible on the SmartView. | 13 characters | <Ambient temp.> |

### 7.12.5 Commissioning Check

*Engauge*
*SmartView*

☛After having checked/set all before listed entities, make sure

- the [Board Commissioned], the [Product temperature Commissioned], the [Vapour temperature Commissioned], and the [Ambient Temperature Commissioned] entities are <True>;
- the [Board Health], the [Product temperature Health], the [Vapour temperature Health], and the [Ambient Temperature Health] entities are <GOOD>.

For viewing the *software version,* the Engauge *Generic tab* can be viewed; also a *Reset board command* can be issued here.

*NOTE: In the SmartView situation, the Commissioning flag must be 'G' and the Health flag must be 'Y'.*

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